SGS®

Solid Carbide Tools

An ISO 9001 Certified Company

High Performance Catalog

www.sgstool.com

Solid Carbide Tools
An ISO 9001 Certified Company

High Performance Solid Carbide Tools

As a technological leader, SGS Tool Company is committed to provide you with leading-edge, high-performance products. We address the complexities of High-Speed Machining with particular focus upon Aerospace, Automotive, Mold & Die, and Production Machining Applications.

Extensive product testing has shown that SGS High Performance Tools can increase productivity rates many times over conventional carbide end mills and drills. The experience we acquire from designing and manufacturing these high-performance products has a positive impact upon every standard and special application tool we produce.

A quiet giant, the patented Z-Carb 4 Flute End Mills have revolutionized milling of ferrous materials with it's unequal helix geometry design. Z-Carb has been recorded to improve productivity up to 30 times over conventional 4-flute end mills and has achieved a 100% increase in radial width of cut.

The Finishing Touch best describes the V-Carb 5 Flute End Mills. The unique geometry and corner radii allows this tool to produce exceptional results in finish and semi-finish milling applications. V-Carb has also performed well in heavy peripheral and slotting applications.

SGS Industry Applications – Icon Key and Matrix

Throughout the SGS Tool Company High Performance Catalog, you'll find icons indicating for which industry applications SGS High Performance products are best suited.

	Mold & Die	Automotive	Aerospace	Power Generation	Castings & Foundries
Z-Carb	●	●	●	●	●
V-Carb	●	●	●	●	●
Tri-Carb	●				●
Turbo-Carb	●	●		●	
Power-Carb	●	●		●	
Ski-Carb		●	●		
S-Carb		●	●		
ICe-Carb	●	●	●		
Hi-PerCarb	●	●	●	●	●
Dia-Carb	●			●	●

The Performance of SGS Solid Carbide, Rotary Cutting Tools can be enhanced in many applications with our specially developed Ti-NAMITE PVD Process Tool Coatings. These proprietary processes result in not only maximum tool life, but also faster cutting speeds and reduction of edge wear. Ti-NAMITE Tool Coatings are developed and processed at our own multi-million dollar facility in Munroe Falls, Ohio USA.

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PATENTED

CARB™

SOLID CARBIDE END MILLS

Revolutionizes Milling

Patented Unequal Helix Geometry

DESIGN BENEFITS

The Z CARB end mill maximizes stock removal and improves productivity in most milling operations. Chatter is the most common problem associated with aggressive milling. The SGS Z CARB design features reduce chatter, increase tool life and optimize performance. Z CARB tools are coated with SGS Ti-NAMITE-A® coating that resists heat generated in aggressive cutting operations.

APPLICATION TIPS

- Tool holders with adequate gripping pressure are required
- Stub length solid holders are recommended for heavy stock removal
- Avoid remilling chips
- Ramping or spiral plunging are the preferred entry methods into pockets (approximately 6° at 50 % normal feed)
- Regrind and recondition services are available from SGS
- Set-up rigidity critical during heavy roughing

Chatter-Resistant Design:

- Improves Surface Finish

Optimum Material Removal:

- Increases Cutting Depth
- Increases Feed Rates

Increased Tool Life:

- Ti-NAMITE-A®(AlTiN Coated)
- Corner Radius
- Special Gash Break Out Grind
- Eccentric Relief

Minimum Tool Deflection:

- Reduces HarmfulMachine Vibration
- Improves Dimensional Control

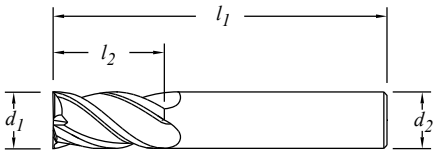
Material Applications Include:

- Low Carbon Steels
- Tool Steels
- Cast Iron
- Stainless Steels
- Titanium/High Temp Alloys

PATENT NUMBERS:

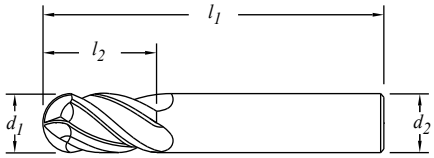
U.S.: 4,963,059
Germany: 3,706,282
Korea: 065,154
Japan: 1513152

Fractional



Z CARB™ Series Z1
4 Flute - Square End

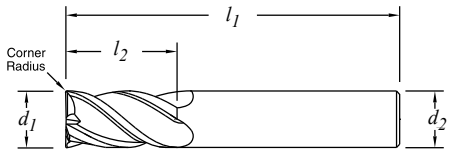
Cutting Diameter d_1	Length of Cut l_2	Overall Length l_1	Shank Diameter d_2	Ti-NAMITE-A (AlTiN) EDP No.	EDP No. w/ flat
1/8	3/8	1-1/2	1/8	36404	
5/32	7/16	2	3/16	36406	
3/16	7/16	2	3/16	36408	
7/32	7/16	2-1/2	1/4	36410	
1/4	1/2	2-1/2	1/4	36416	
9/32	5/8	2-1/2	5/16	36418	
5/16	13/16	2-1/2	5/16	36420	
11/32	13/16	2-1/2	3/8	36422	
3/8	7/8	2-1/2	3/8	36424	36530
13/32	15/16	2-3/4	7/16	36426	36531
7/16	1	2-3/4	7/16	36428	36532
15/32	1	3	1/2	36430	36533
1/2	1	3	1/2	36432	36534
9/16	1-1/8	3-1/2	9/16	36436	36535
5/8	1-1/4	3-1/2	5/8	36440	36536
3/4	1-1/2	4	3/4	36442	36537
1	1-1/2	4	1	36444	36538



Z CARB™ Series Z1B
4 Flute - Ball End

Cutting Diameter d_1	Length of Cut l_2	Overall Length l_1	Shank Diameter d_2	Ti-NAMITE-A (AlTiN) EDP No.	EDP No. w/ flat
1/8	3/8	1-1/2	1/8	36358	
5/32	7/16	2	3/16	36357	
3/16	7/16	2	3/16	36359	
7/32	7/16	2-1/2	1/4	36361	
1/4	1/2	2-1/2	1/4	36344	
9/32	5/8	2-1/2	5/16	36353	
5/16	13/16	2-1/2	5/16	36345	
11/32	13/16	2-1/2	3/8	36354	
3/8	7/8	2-1/2	3/8	36346	36539
13/32	15/16	2-3/4	7/16	36355	36540
7/16	1	2-3/4	7/16	36347	36541
15/32	1	3	1/2	36356	36542
1/2	1	3	1/2	36348	36543
9/16	1-1/8	3-1/2	9/16	36349	36544
5/8	1-1/4	3-1/2	5/8	36350	36545
3/4	1-1/2	4	3/4	36351	36546
1	1-1/2	4	1	36352	36547

Tolerances (inch)		
Diameter	d_1	d_2
1/8 – 1/4	+.0000/–.0012	–.0001/–.0003
> 1/4 – 3/8	+.0000/–.0016	–.0001/–.0003
> 3/8 – 1	+.0000/–.0020	–.0001/–.0004



Z CARB™ Series Z1CR
4 Flute - Corner Radius

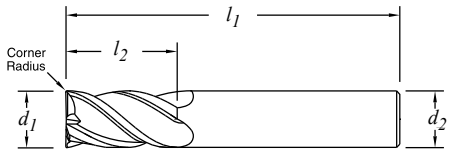
Cutting Diameter d_1	Length of Cut l_2	Overall Length l_1	Shank Diameter d_2	Corner Radius	Ti-NAMITE-A (AlTiN) EDP No.	EDP No. w/ flat
1/8	3/8	1-1/2	1/8	.010 -.015	36333	
3/16	7/16	2	3/16	.010 -.015	36334	
1/4	1/2	2-1/2	1/4	.015 - .020	36335	
5/16	13/16	2-1/2	5/16	.015 - .020	36336	
3/8	7/8	2-1/2	3/8	.015 - .020	36337	36548
7/16	1	2-3/4	7/16	.015 - .020	36338	36549
1/2	1	3	1/2	.025 - .030	36339	36550
9/16	1-1/8	3-1/2	9/16	.025 - .030	36340	36551
5/8	1-1/4	3-1/2	5/8	.035 - .040	36341	36552
3/4	1-1/2	4	3/4	.035 - .040	36342	36553
1	1-1/2	4	1	.035 - .040	36343	36554

PATENTED

CARB™

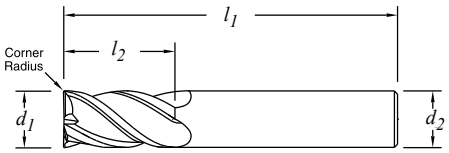
SOLID CARBIDE END MILLS

Fractional



Z CARB™ Series Z1CR
4 Flute Specific Corner Radius

Cutting Diameter d_1	Length of Cut l_2	Overall Length l_1	Shank Diameter d_2	Corner Radius	TiNAMITE-A (AlTiN) EDP Number	TiNAMITE-A (AlTiN) EDP Number w/Flat
1/8	3/8	1-1/2	1/8	.010	36370	
3/16	7/16	2	3/16	.010	36371	
1/4	1/2	2-1/2	1/4	.010	36372	
1/4	1/2	2-1/2	1/4	.030	36373	
5/16	13/16	2-1/2	5/16	.030	36374	
3/8	7/8	2-1/2	3/8	.010	36375	36701
3/8	7/8	2-1/2	3/8	.030	36376	36702
7/16	1	2-3/4	7/16	.030	36377	36703
1/2	1	3	1/2	.010	36378	36704
1/2	1	3	1/2	.030	36379	36705
1/2	1	3	1/2	.060	36380	36706
1/2	1	3	1/2	.090	36381	36707
9/16	1-1/8	3-1/2	9/16	.030	36382	36708
5/8	1-1/4	3-1/2	5/8	.030	36383	36709
5/8	1-1/4	3-1/2	5/8	.060	36384	36710
5/8	1-1/4	3-1/2	5/8	.090	36385	36711
3/4	1-1/2	4	3/4	.030	36386	36712
3/4	1-1/2	4	3/4	.060	36387	36713
3/4	1-1/2	4	3/4	.090	36388	36714
3/4	1-1/2	4	3/4	.125	36389	36715
1	1-1/2	4	1	.030	36390	36716
1	1-1/2	4	1	.060	36391	36717
1	1-1/2	4	1	.090	36392	36718
1	1-1/2	4	1	.125	36393	36719



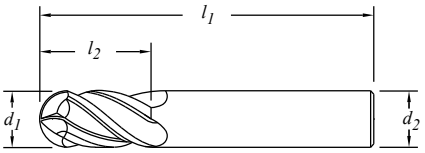
Z CARB™ Series Z1LC - 4 Flute
Long Reach with Corner Radius

Cutting Diameter d_1	Length of Cut l_2	Overall Length l_1	Shank Diameter d_2	Corner Radius	Ti-NAMITE-A (AlTiN) EDP No.
1/4	1/2	4	1/4	.015 - .020	36450
5/16	13/16	4	5/16	.015 - .020	36452
3/8	7/8	5	3/8	.015 - .020	36456
7/16	1	6	7/16	.015 - .020	36460
1/2	1	6	1/2	.025 - .030	36462
9/16	1-1/8	6	9/16	.025 - .030	36466
5/8	1-1/4	6	5/8	.035 - .040	36470
3/4	1-1/2	6	3/4	.035 - .040	36472
1	1-1/2	6	1	.035 - .040	36474

Tolerances (inch)		
Diameter	d_1	d_2
1/8 – 1/4	+.0000/–.0012	–.0001/–.0003
> 1/4 – 3/8	+.0000/–.0016	–.0001/–.0003
> 3/8 – 1	+.0000/–.0020	–.0001/–.0004

SPECIFIC CORNER RADIUS TOLERANCES
+.000/-.002

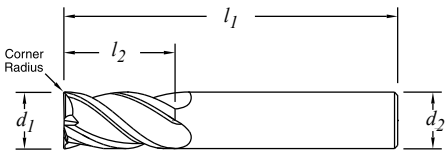
Fractional



Z CARB™ Series Z1LB - 4 Flute
Long Reach Ball End

Cutting Diameter d_1	Length of Cut l_2	Overall Length l_1	Shank Diameter d_2	Ti-NAMITE-A (AlTiN) EDP No.
1/4	1/2	4	1/4	36480
5/16	13/16	4	5/16	36482
3/8	7/8	5	3/8	36486
7/16	1	6	7/16	38490
1/2	1	6	1/2	38492
9/16	1-1/8	6	9/16	38496
5/8	1-1/4	6	5/8	36500
3/4	1-1/2	6	3/4	36502
1	1-1/2	6	1	36504

Tolerances (inch)		
Diameter	d_1	d_2
1/8 – 1/4	+.0000/–.0012	–.0001/–.0003
> 1/4 – 3/8	+.0000/–.0016	–.0001/–.0003
> 3/8 – 1	+.0000/–.0020	–.0001/–.0004



Z CARB™ Series Z16CR - 4 Flute
Short Length with Corner Radius

Cutting Diameter d_1	Length of Cut l_2	Overall Length l_1	Shank Diameter d_2	Corner Radius	Ti-NAMITE-A (AlTiN) EDP No.
1/8	1/4	1-1/2	1/8	.010 - .015	36505
5/32	5/16	2	3/16	.010 - .015	36506
3/16	3/8	2	3/16	.010 - .015	36507
7/32	3/8	2	1/4	.015 - .020	36508
1/4	7/16	2	1/4	.015 - .020	36509
5/16	1/2	2	5/16	.015 - .020	36511
3/8	5/8	2	3/8	.015 - .020	36513
7/16	5/8	2-1/2	7/16	.015 - .020	36515
1/2	5/8	2-1/2	1/2	.025 - .030	36517
5/8	3/4	3	5/8	.035 - .040	36519
3/4	1	3	3/4	.035 - .040	36520

Fractional - Speed and Feed Recommendations

Material	Bhn	CUTTING DIAMETER (d_1) 1/8		3/16		1/4		5/16		3/8		7/16		1/2		5/8		3/4		1	
		rpm	in/min	rpm	in/min	rpm	in/min	rpm	in/min	rpm	in/min	rpm	in/min	rpm	in/min	rpm	in/min	rpm	in/min	rpm	in/min
low carbon steels	~175	15,585	12	10,362	20	7,793	24	6,234	29	5,195	39	4,453	38	3,896	37	3,117	33	2,598	31	1,948	25
low carbon steels	~275	12,835	10	8,148	17	6,418	20	5,134	24	4,278	32	3,667	31	3,209	30	2,567	27	2,139	25	1,604	21
med alloy steels	~275	10,696	8	6,790	14	5,348	17	4,278	20	3,565	27	3,056	26	2,674	25	2,139	23	1,783	21	1,337	17
mold and die steels	~275	5,500	4	3,492	8	2,750	8	2,200	10	1,834	13	1,572	13	1,375	13	1,100	11	917	11	688	9
cast iron - gray	~200	14,516	11	9,215	19	7,258	23	5,806	27	4,839	36	4,147	35	3,629	34	2,903	31	2,419	29	1,815	24
cast iron - ductile	~300	7,334	5	4,656	9	3,667	11	2,934	14	2,445	18	2,096	18	1,834	17	1,467	15	1,222	14	917	12
cast iron - malleable	~300	4,584	4	2,910	6	2,292	7	1,834	8	1,528	11	1,310	11	1,146	11	917	9	764	9	573	7
stainless 300 series	~275	9,168	7	5,820	12	4,584	14	3,667	16	3,056	16	2,619	16	2,292	16	1,834	16	1,528	15	1,146	15
stainless 400 series	~185	12,835	10	8,245	17	6,418	22	5,134	25	4,278	25	3,667	25	3,209	25	2,567	25	2,139	22	1,604	22
stainless PH series	~325	7,640	5	4,850	10	3,820	12	3,056	14	2,547	14	2,183	14	1,910	14	1,528	14	1,273	12	955	12
titanium alloys	~295	9,168	9	5,820	14	4,584	16	3,667	18	3,056	18	2,619	18	2,292	18	1,834	18	1,528	16	1,146	16
high temp alloys	~300	2,444	2	1,552	3	1,222	3	978	4	815	4	700	4	611	4	489	4	408	4	306	3

Profiling: Radial Width .5 x Diameter (max.)

Profiling: Axial Depth 1.5 x Diameter (max.)

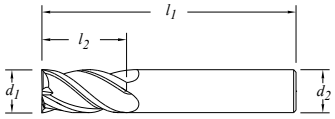
Slotting: Axial Depth 1 x Diameter (max.)

PATENTED

Z CARB™

SOLID CARBIDE END MILLS

Metric

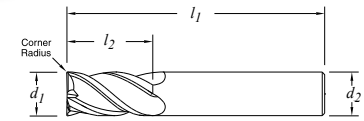


Z CARB™ Series Z1M - 4 Flute - Square End

Cutting Diameter d_1 mm	Length of Cut l_2 mm	Overall Length l_1 mm	Shank Diameter d_2 mm	Ti-NAMITE-A (AlTiN) EDP No.
3	8	57	6	46357
4	11	57	6	46358
5	13	57	6	46359
6	13	57	6	46360
8	19	63	8	46362
10	22	72	10	46364
12	26	83	12	46366
14	26	83	14	46368
16	32	92	16	46370
18	32	92	18	46372
20	38	104	20	46374
25	38	104	25	46376

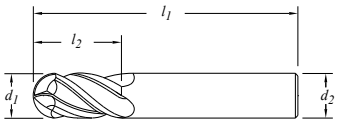
Z CARB™ Series Z1MB - 4 Flute - Ball End

Cutting Diameter d_1 mm	Length of Cut l_2 mm	Overall Length l_1 mm	Shank Diameter d_2 mm	Ti-NAMITE-A (AlTiN) EDP No.
3	8	57	6	46354
4	11	57	6	46355
5	13	57	6	46356
6	13	57	6	46343
8	19	63	8	46344
10	22	72	10	46345
12	26	83	12	46346
14	26	83	14	46347
16	32	92	16	46348
18	32	92	18	46349
20	38	104	20	46350
25	38	104	25	46351



Z CARB™ Series Z1MCR - 4 Flute - Corner Radius

Cutting Diameter d_1 mm	Length of Cut l_2 mm	Overall Length l_1 mm	Shank Diameter d_2 mm	Corner Radius	Ti-NAMITE-A (AlTiN) EDP No.
3	8	57	6	0,25-0,38	46377
4	11	57	6	0,25-0,38	46378
5	13	57	6	0,25-0,38	46379
6	13	57	6	0,38-0,51	46335
7	19	63	8	0,38-0,51	46380
8	19	63	8	0,38-0,51	46336
9	22	72	10	0,38-0,51	46381
10	22	72	10	0,38-0,51	46337
11	26	83	12	0,64-0,76	46382
12	26	83	12	0,64-0,76	46338
13	26	92	16	0,64-0,76	46383
14	26	83	14	0,64-0,76	46339
14	26	92	16	0,64-0,76	46384
15	32	92	16	0,89-1.02	46385
16	32	92	16	0,89-1,02	46340
18	32	92	18	0,89-1,02	46341
18	32	104	20	0,89-1.02	46386
20	38	104	20	0,89-1,02	46342
25	38	104	25	0,89-1,02	46334



Tolerances (mm)		
Diameter	d_1	d_2
3 – 6	+0,000/–0,030	–0,0025/–0,0075
> 6 – 10	+0,000/–0,040	–0,0025/–0,0075
> 10 – 25	+0,000/–0,050	–0,0025/–0,010

Metric - Z-CARB™- Speed and Feed Recommendations

Material	Bhn	CUTTING DIAMETER (d_1) 3		5		6		8		10		12		14		16		18		20	
		rpm	mm/min	rpm	mm/min	rpm	mm/min	rpm	mm/min	rpm	mm/min	rpm	mm/min	rpm	mm/min	rpm	mm/min	rpm	mm/min	rpm	mm/min
low carbon steels	~175	16,500	335	9,894	502	8,248	586	6,185	754	4,948	955	4,124	963	3,535	890	3,093	817	2,749	809	2,474	804
low carbon steels	~275	13,585	276	8,148	413	6,793	483	5,093	620	4,075	786	3,396	793	2,911	733	2,547	672	2,264	667	2,038	662
med alloy steels	~275	11,320	230	6,790	345	5,661	403	4,244	517	3,396	656	2,830	661	2,425	592	2,123	561	1,887	556	1,698	552
mold and die steels	~275	5,822	118	3,492	177	2,911	207	2,183	266	1,747	337	1,456	340	1,248	314	1,092	288	970	285	873	283
cast iron - gray	~200	15,364	300	9,215	468	7,682	546	5,760	702	4,609	889	3,841	897	3,292	829	2,881	761	2,560	754	2,304	749
cast iron - ductile	~300	7,763	158	4,656	236	3,882	276	2,911	354	2,329	449	1,941	453	1,663	419	1,456	384	1,294	381	1,164	378
cast iron - malleable	~300	4,852	98	2,911	147	2,426	173	1,819	221	1,455	280	1,213	283	1,040	262	910	240	809	238	728	236
stainless 300 series	~275	9,704	175	5,820	300	4,852	355	3,638	405	2,911	405	2,426	405	2,079	405	1,819	405	1,617	380	1,455	380
stainless 400 series	~185	13,585	250	8,245	430	6,793	560	5,093	635	4,075	635	3,396	635	2,911	635	2,547	635	2,264	560	2,038	560
stainless PH series	~325	8,086	125	4,850	250	4,043	300	3,032	355	2,426	355	2,022	355	1,733	355	1,516	355	1,348	300	1,213	300
titanium alloys	~295	9,704	225	5,820	355	4,852	405	3,638	455	2,911	455	2,426	455	2,079	455	1,819	455	1,617	405	1,455	405
high temp alloys	~300	2,588	50	1,552	75	1,294	75	970	100	776	100	647	100	554	100	485	100	431	100	388	100

Profiling: Radial Width .5 x Diameter (max.)
Axial Depth 1.5 x Diameter (max.)

Profiling: Axial Depth 1.5 x Diameter (max.)
Axial Depth 1.5 x Diameter (max.)

Slotting: Axial Depth 1 x Diameter (max.)

PATENTED

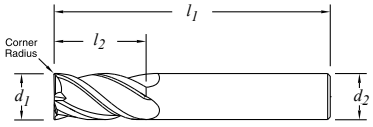
Z-CARB-HTA
SOLID CARBIDE END MILLS
For High Temp Alloys

Fractional

Features and Benefits

- **Maximum Rigidity**
  - –Provides additional resistance against chipping and breakage
  - –Allows higher material removal rates
- **Reduced Cutting Forces**
  - –Provides superior dimensional control and workpiece finishes
  - –Lower heat generation and improved wear resistance
- **Certified Premium Micro-Grain Carbide**
- **Ti-Namite-A® (AlTiN) Coating**

Z-CARB™-HTA Series ZH1CR
4 Flute Fractional Corner Radius



Cutting Diameter d_1	Length of Cut l_2	Overall Length l_1	Shank Diameter d_2	Corner Radius	Ti-NAMITE-A (AlTiN) EDP Number	Ti-NAMITE-A (AlTiN) EDP Number w/Flat
1/4	1/2	2-1/2	1/4	.015 - .020	**36570**	–
5/16	13/16	2-1/2	5/16	.015 - .020	**36571**	–
3/8	7/8	2-1/2	3/8	.015 - .020	**36572**	**36555**
7/16	1	2-3/4	7/16	.015 - .020	**36573**	**36556**
1/2	1	3	1/2	.025 - .030	**36574**	**36557**
9/16	1-1/8	3-1/2	9/16	.025 - .030	**36575**	**36558**
5/8	1-1/4	3-1/2	5/8	.035 - .040	**36576**	**36559**
3/4	1-1/2	4	3/4	.035 - .040	**36577**	**36560**
1	1-1/2	4	1	.035 - .040	**36578**	**36561**

TOLERANCES	
Cutting Diameter d_1	Shank Diameter d_2
1/4 = +.0000/-.0012	1/4 - 3/8 = -.0001/-.0003
>1/4 - 3/8 = +.0000/-.0016	>3/8 - 1 = -.0001/-.0004
>3/8 - 1 = +.0000/-.002	

Speed and Feed Recommendations-Fractional

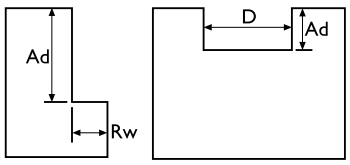
Cutting Diameter

High Temp. Alloys	Bhn	1/4 rpm	1/4 in/min	5/16 rpm	5/16 in/min	3/8 rpm	3/8 in/min	7/16 rpm	7/16 in/min	1/2 rpm	1/2 in/min	9/16 rpm	9/16 in/min	5/8 rpm	5/8 in/min	3/4 rpm	3/4 in/min	1 rpm	1 in/min
Profile–Semi-Rough	<300	1,990	9.6	1,600	9.7	1,325	9.8	1,135	9.9	995	9.9	885	9.9	795	9.9	660	9.7	500	9.7
Profile–Rough	<300	1,680	6.4	1,345	6.5	1,120	6.6	960	6.7	840	6.7	750	6.7	670	6.7	560	6.5	420	6.5
Slotting	<300	1,380	3.9	1,100	4.0	920	4.1	785	4.2	690	4.2	610	4.2	550	4.2	460	4.0	345	4.0
Profile–Semi-Rough	>300	1,840	7.1	1,470	7.2	1,220	7.3	1,050	7.4	920	7.4	815	7.4	735	7.4	610	7.2	460	7.2
Profile–Rough	>300	1,530	4.0	1,225	4.1	1,020	4.2	875	4.3	765	4.3	680	4.3	610	4.3	510	4.1	380	4.1
Slotting	>300	1,220	2.2	980	2.3	815	2.4	700	2.5	610	2.5	545	2.5	490	2.5	410	2.3	305	2.3

Profile – Semi-Rough: Radial Width .25 x Diameter (max.)
Axial Depth 1.5 x Diameter (max.)

Profile – Rough: Radial Width .5 x Diameter (max.)
Axial Depth 1.5 x Diameter (max.)

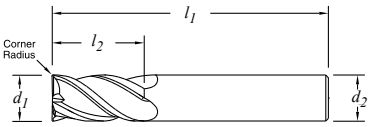
Slotting: Axial Depth 1 x Diameter (max.)



Radial Width of Cut **(Rw)**
Axial Depth of Cut **(Ad)**
Tool Diameter **(D)**

Z-CARB™-HTA Series ZH1CR
4 Flute Metric Specific Corner Radius

Cutting Diameter $d_1$mm	Length of Cut $l_2$mm	Overall Length $l_1$mm	Shank Diameter $d_2$mm	Corner Radius	Ti-NAMITE-A (AlTiN) EDP Number	Ti-NAMITE-A (AlTiN) EDP Number w/Flat
6	13	57	6	0.5	46450	
6	13	57	6	1.0	46451	
6	13	57	6	1.5	46452	
8	19	63	8	0.5	46453	
8	19	63	8	1.0	46454	
8	19	63	8	1.5	46455	
10	22	72	10	0.5	46456	
10	22	72	10	1.0	46457	
10	22	72	10	1.5	46458	
10	22	72	10	2.0	46459	
12	26	83	12	0.5	46460	46471
12	26	83	12	1.0	46461	46472
12	26	83	12	1.5	46462	46473
12	26	83	12	2.0	46463	46474
12	26	83	12	3.0	46464	46475
16	32	92	16	1.5	46465	46476
16	32	92	16	2.0	46466	46477
16	32	92	16	3.0	46467	46478
20	38	104	20	3.0	46468	46479
20	38	104	20	4.0	46469	46480
20	38	104	20	5.0	46470	46481



TOLERANCES	
Cutting Diameter	Shank Diameter
6 = +0/-0,030 >6 - 10 = +0/-0,040	6 - 10 = -0,0025/-0,0075 >10-20 = -0,0025/-0,010
>10 - 20 = +0/-0,050	

Speed and Feed Recommendations-Metric

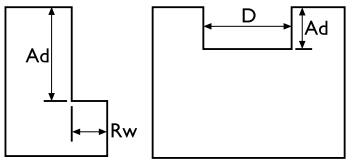
Cutting Diameter

High Temp. Alloys	Bhn	6 rpm	6 mm/min	8 rpm	8 mm/min	10 rpm	10 mm/min	12 rpm	12 mm/min	16 rpm	16 mm/min	20 rpm	20 mm/min
Profile–Semi-Rough	<300	2,100	244	1,575	246	1,260	248	1,050	252	790	252	630	246
Profile–Rough	<300	1,780	163	1,335	165	1,070	168	890	170	670	170	535	165
Slotting	<300	1,455	100	1,090	102	875	104	730	108	545	108	440	102
Profile–Semi-Rough	>300	1,940	180	1,455	182	1,165	185	970	188	730	188	585	182
Profile–Rough	>300	1,620	102	1,215	104	970	106	810	110	610	110	485	104
Slotting	>300	1,295	55	970	58	775	60	650	64	485	64	390	58

Profile – Semi-Rough: Radial Width .25 x Diameter (max.)
Axial Depth 1.5 x Diameter (max.)

Profile – Rough: Radial Width .5 x Diameter (max.)
Axial Depth 1.5 x Diameter (max.)

Slotting: Axial Depth 1 x Diameter (max.)



Radial Width of Cut **(Rw)**
Axial Depth of Cut **(Ad)**
Tool Diameter **(D)**

JetStream
PATENTED COOLANT TECHNOLOGY

Precise Coolant Delivery and Z-Carb Strength

Benefits

- More consistent machining temperatures
- Reduced damage from harmful heat created during machining
- Helps to reduce the development of built up edge (BUE)
- The ability to improve cutting speeds
- Improved tool life
- Improved chip control
- Decreased damage from recutting chips
- Reduced cutting loads and forces
- Helps to improve workpiece accuracy
- Helps to improve workpiece surface finish
- Helps to avoid coolant waste

Speed and Feed Notes

- Avoid re-milling chips
- Tool holders with adequate gripping pressure are required
- Stub length solid holders are recommended for heavy stock removal
- Ramping or spiral plunging are the preferred entry methods into pockets (approximately 6 degrees @ 50% normal feed)

Z-Carb End Mills with JetStream Patented Coolant Technology

SGS Tool Company is proud to introduce the newest member of the Z-Carb family of products: Z-Carb End Mills with JetStream patented coolant technology.

With the JetStream Z-Carb End Mill, coolant is delivered with targeted precision via 4 connected in-line coolant channels.

The uniquely positioned coolant channels are engineered and patented to maximize coolant flow and delivery to the shear zone. The JetStream Z-Carb End Mill was designed to take maximum advantage of the benefits that a properly delivered coolant produces in a demanding machining application.

Enjoy genuine Z-Carb performance enhanced by the benefits of exact coolant delivery in your slotting, pocketing and hard-to-access applications.

Heat is one of the most damaging side effects of the machining process. Heat limits operating parameters, dictates tool life, affects chip control and determines workpiece quality. Coolant aids in the effort to better control these problems, but only if it is applied with accuracy and consistency. When working with carbide tools, intermittent cooling can create thermal stress and lead to premature tool failure.

PATENT NUMBERS:
U.S.: 4,963,059
Germany: 3,706,282
Korea: 065,154
Japan: 1513152

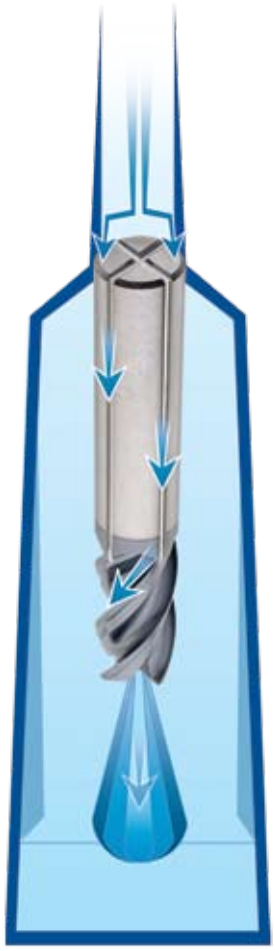
This is particularly true in slotting, pocketing and hard-to-access applications where targeted coolant application with external coolant lines becomes increasingly difficult. SGS Tool Company has taken patented Z-Carb technology, which already permits more aggressive machining through chatter suppression, and added a new, patented coolant channel design to take advantage of the benefits of precise coolant delivery.

Designed with the strength of a solid carbide Z-Carb, the high performance JetStream end mill delivers coolant to the cutting zone with effective pressure, volume and accuracy.

Coolant channels in solid carbide end mills are not a new concept, but the patented design on the JetStream Z-Carb is. Strategically located channels interconnect at the shank end of the tool to offer unparalleled results as only the Z-Carb can.

Proper application of coolant allows the end user to reduce friction, machine load, material adhesion and chip congestion through proper lubrication, while simultaneously reducing heat, improving part quality, controlling chip formation and increasing operating parameters through proper cooling. By delivering the appropriate pressure and volume of coolant where it is needed, these benefits, combined with increased chip evacuation and targeted application result in improved tool life and profitability.

Maximize your tool life, profitability and part quality with the targeted lubricating, cooling and chip evacuation properties delivered by the JetStream Z-Carb End Mill.

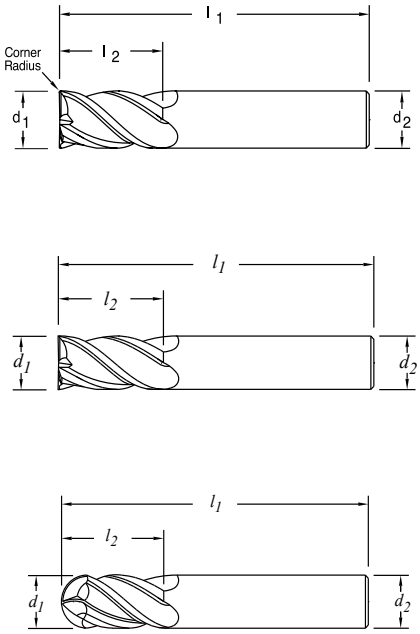


The JetStream Z-Carb End Mill should be used with a minimum coolant pressure of 250 PSI.

JetStream
PATENTED COOLANT TECHNOLOGY

Fractional

Engineered delivery channels direct the coolant to millpoint and workpiece.



TOLERANCES:	
Cutting Diameter	**Shank Diameter**
1/8-1/4 = +0/-.0012	
1/4 = +0/-.0012	1/8 - 3/8 = -.0001 / -.0003
>1/4 - 3/8 = +0/-.0016	>3/8 - 1 = -.0001 / -.0004
>3/8 - 1 = +0/-.002	

Z-CARB™ SERIES Z1CR - FRACTIONAL CORNER RADIUS - JETSTREAM

Cutting Diameter d_1	Length of Cut l_2	Overall Length l_1	Shank Diameter d_2	Corner Radius	Ti-NAMITE-A (AlTiN) EDP No.
1/2	1	3	1/2	.025 - .030	36805
9/16	1-1/8	3-1/2	9/16	.025 - .030	36806
5/8	1-1/4	3-1/2	5/8	.035 - .040	36807
3/4	1-1/2	4	3/4	.035 - .040	36808
1	1-1/2	4	1	.035 - .040	36809

Z-CARB™ SERIES Z1 - FRACTIONAL SQUARE END - JETSTREAM

Cutting Diameter d_1	Length of Cut l_2	Overall Length l_1	Shank Diameter d_2	Ti-NAMITE-A (AlTiN) EDP No.
1/2	1	3	1/2	36826
9/16	1-1/8	3-1/2	9/16	36827
5/8	1-1/4	3-1/2	5/8	36828
3/4	1-1/2	4	3/4	36829
1	1-1/2	4	1	36830

Z-CARB™ SERIES Z1B - FRACTIONAL BALL END - JETSTREAM

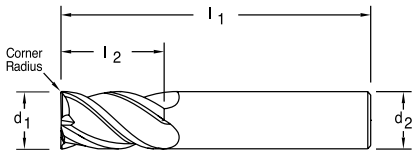
Cutting Diameter d_1	Length of Cut l_2	Overall Length l_1	Shank Diameter d_2	Ti-NAMITE-A (AlTiN) EDP No.
1/2	1	3	1/2	36846
9/16	1-1/8	3-1/2	9/16	36847
5/8	1-1/4	3-1/2	5/8	36848
3/4	1-1/2	4	3/4	36849
1	1-1/2	4	1	36850

Z-Carb Speed and Feed Recommendations - FRACTIONAL JETSTREAM

material type	Bhn	Cutting Diameter 1/2		9/16		5/8		3/4		1	
		rpm	in/min	rpm	in/min	rpm	in/min	rpm	in/min	rpm	in/min
low carbon steels	~175	3896	37	3464	35	3117	33	2598	31	1948	25
low carbon steels	~275	3209	30	2852	29	2567	27	2139	25	1604	21
med alloy steels	~275	2674	25	2377	24	2139	23	1783	21	1337	17
mold and die steels	~275	1375	13	1222	12	1100	11	917	11	688	9
cast iron - gray	~200	3629	34	3226	32	2903	31	2419	29	1815	24
cast iron - ductile	~300	1834	17	1630	16	1467	15	1222	14	917	12
cast iron - malleable	~300	1146	11	1019	10	917	9	764	9	573	7
stainless 300 series	~275	2292	16	2037	20	1834	16	1528	15	1146	15
stainless 400 series	~185	3209	25	2852	29	2567	25	2139	22	1604	22
stainless PH series	~325	1910	14	1698	17	1528	14	1273	12	955	12
titanium alloys	~295	2292	18	2037	20	1834	18	1528	16	1146	16
high temp. alloys	~300	611	4	543	6	489	4	408	4	306	3

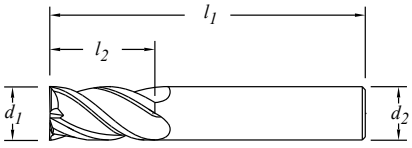
Profiling: Radial Width .5 x Diameter (max.) Profiling: Axial Depth 1.5 x Diameter (max.) Slotting: Axial Depth 1 x Diameter (max.)

Engineered delivery channels direct the coolant to millpoint and workpiece.



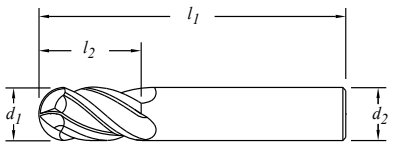
Z-CARB™ SERIES Z1MCR - METRIC CORNER RADIUS - JETSTREAM

Cutting Diameter d_1 mm	Length of Cut l_2 mm	Overall Length l_1 mm	Shank Diameter d_2 mm	Corner Radius	Ti-NAMITE-A (AlTiN) EDP No.
14	26	83	14	0,64-0,76	46494
16	32	92	16	0,89-1,02	46495
18	32	92	18	0,89-1,02	46496
20	38	104	20	0,89-1,02	46497
25	38	104	25	0,89-1,02	46498



Z-CARB™ SERIES Z1M - METRIC SQUARE END - JETSTREAM

Cutting Diameter d_1 mm	Length of Cut l_2 mm	Overall Length l_1 mm	Shank Diameter d_2 mm	Ti-NAMITE-A (AlTiN) EDP No.
14	26	83	14	46506
16	32	92	16	46507
18	32	92	18	46508
20	38	104	20	46509
25	38	104	25	46510



Z-CARB™ SERIES Z1MB - METRIC BALL END - JETSTREAM

Cutting Diameter d_1 mm	Length of Cut l_2 mm	Overall Length l_1 mm	Shank Diameter d_2 mm	Ti-NAMITE-A (AlTiN) EDP No.
14	26	83	14	46518
16	32	92	16	46519
18	32	92	18	46520
20	38	104	20	46521
25	38	104	25	46522

TOLERANCES:	
Cutting Diameter	**Shank Diameter**
>6-10 = +0,0000/-0,040	6-10 = -0,0025 / -0,0075
>10-25 = +0,0000/-0,050	>10-25 = -0,0025 / -0,010

Z-Carb Speed and Feed Recommendations - METRIC JETSTREAM

material type	Bhn	Cutting Diameter 14		16		18		20	
		rpm	mm/min	rpm	in/min	rpm	in/min	rpm	in/min
low carbon steels	~175	3535	890	3093	817	2749	809	2474	804
low carbon steels	~275	2911	733	2547	672	2264	667	2038	662
med alloy steels	~275	2425	592	2123	561	1887	556	1698	552
mold and die steels	~275	1248	314	1092	288	970	285	873	283
cast iron - gray	~200	3292	829	2881	761	2560	754	2304	749
cast iron - ductile	~300	1663	419	1456	384	1294	381	1164	378
cast iron - malleable	~300	1040	262	910	240	809	238	728	236
stainless 300 series	~275	2079	405	1819	405	1617	380	1455	380
stainless 400 series	~185	2911	635	2547	635	2264	560	2038	560
stainless PH series	~325	1733	355	1516	355	1348	300	1213	300
titanium alloys	~295	2079	455	1819	455	1617	405	1455	405
high temp alloys	~300	554	100	485	100	431	100	388	100

CARB™

Five Flute End Mills

The Finishing Touch

Expect More From a Finishing Mill

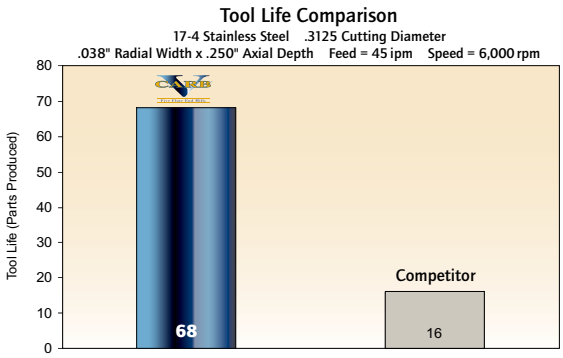
Produce exceptional results in semi-finish and finish milling applications. Tackle heavy milling tasks, including roughing and slotting.

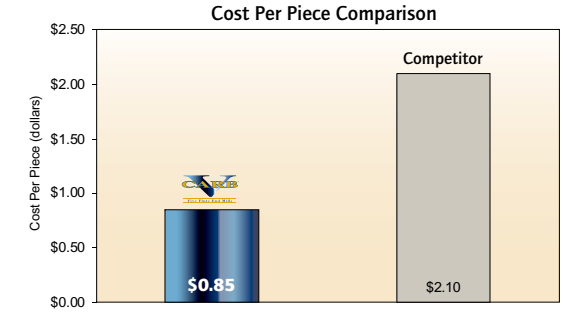
Features & Benefits

- Unique 5-flute geometry
- Certified premium micro-grain carbide
- Available in stub-, regular-, and long-flute lengths
- Corner radii improves strength
- Ti-NAMITE-A (AlTiN) coated for longer tool life
- Reduced harmonics:
  - Improved finishes
  - Heavier stock removal
- Can be run at higher production rates
- Suitable for a variety of materials up to 45 Rc

Application Tips

- Tool holders with adequate gripping pressure are required
- Stub length solid holders are recommended for heavy stock removal
- Avoid remilling chips
- Set-up rigidity critical during heavy roughing
- Regrind and recondition services are available from SGS Tool Company





Fractional

V-CARB™ - Series 55CR - 5 Flute End Mills with Corner Radius

Cutting Diameter d_1	Length of Cut l_2	Overall Length l_1	Shank Diameter d_2	Corner Radius	Ti-NAMITE-A (AlTiN) EDP Number	Ti-NAMITE-A (AlTiN) EDP Number w/Flat
1/8	1/4	1-1/2	1/8	.010+.0/-.002	32606	
1/8	1/2	1-1/2	1/8	.010+.0/-.002	32607	
5/32	5/16	2	3/16	.010+.0/-.002	32608	
5/32	9/16	2	3/16	.010+.0/-.002	32609	
3/16	5/16	2	3/16	.010+.0/-.002	32610	
3/16	5/8	2	3/16	.010+.0/-.002	32611	
7/32	3/8	2	1/4	.015+.0/-.002	32612	
7/32	3/4	2-1/2	1/4	.015+.0/-.002	32613	
1/4	3/8	2	1/4	.015+.0/-.002	32614	
1/4	3/4	2-1/2	1/4	.015+.0/-.002	32615	
1/4	1-1/4	4	1/4	.015+.0/-.002	32616	
5/16	7/16	2	5/16	.015+.0/-.002	32619	
5/16	13/16	2-1/2	5/16	.015+.0/-.002	32620	
5/16	1-1/4	4	5/16	.015+.0/-.002	32621	
3/8	1/2	2	3/8	.015+.0/-.002	32625	
3/8	1	2-1/2	3/8	.015+.0/-.002	32626	32628
3/8	1-1/2	4	3/8	.015+.0/-.002	32627	
7/16	1	2-3/4	7/16	.015+.0/-.002	32632	
7/16	2	4	7/16	.015+.0/-.002	32633	
1/2	5/8	2-1/2	1/2	.025+.0/-.002	32636	
1/2	1-1/4	3	1/2	.025+.0/-.002	32637	32639
1/2	2	4	1/2	.025+.0/-.002	32638	
5/8	1-5/8	3-1/2	5/8	.035+.0/-.002	32642	32644
5/8	2-1/2	5	5/8	.035+.0/-.002	32643	
3/4	1	3	3/4	.035+.0/-.002	32645	
3/4	1-5/8	4	3/4	.035+.0/-.002	32646	32649
3/4	3-1/4	6	3/4	.035+.0/-.002	32648	
1	1-1/2	4	1	.035+.0/-.002	32651	32654
1	2-5/8	6	1	.035+.0/-.002	32653	

Tolerances (inch)		
Diameter	d1	d2
1/8 - 1	+.0000 / -.0020	-.0001 / -.0004

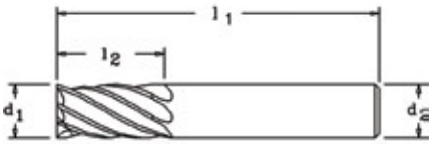
CARB™

Five Flute End Mills

Fractional

V-CARB™ - Series 55 - Fractional - 5 Flute End Mills With Square Corner

Cutting Diameter d_1	Length of Cut l_2	Overall Length l_1	Shank Diameter d_2	Ti-NAMITE-A (AlTiN) EDP No.	Ti-NAMITE-A (AlTiN)w/Flat EDP No.
1/8	1/2	1-1/2	1/8	32655	
5/32	9/16	2	3/16	32656	
3/16	5/8	2	3/16	32657	
7/32	3/4	2-1/2	1/4	32658	
1/4	3/4	2-1/2	1/4	32659	
5/16	13/16	2-1/2	5/16	32660	
3/8	1	2-1/2	3/8	32661	32662
7/16	1	2-3/4	7/16	32663	
1/2	1-1/4	3	1/2	32664	32665
5/8	1-5/8	3-1/2	5/8	32666	32667
3/4	1-5/8	4	3/4	32668	32669
1	1-1/2	4	1	32670	32671



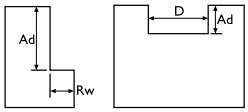
V-CARB™ - Series 55CR and 55 - Fractional 5 Flute End Mills

Speed and Feed Recommendations

	Finishing★★★★				Semi-Finishing★★★				Heavy Peripheral★★				Slotting★			
	Rw	Ad	SpC	FeC	Rw	Ad	SpC	FeC	Rw	Ad	SpC	FeC	Rw	Ad	SpC	FeC
Stub	.05 x D	LOC	0	0	.1 x D	LOC	.8	1.2	.5 x D	1.25 x D	.6	.35	1 x D	.7 x D	.5	.30
Reg	.05 x D	LOC	0	0	.1 x D	LOC	.8	1.2	.5 x D	1 x D	.6	.35	1 x D	.5 x D	.5	.30
***Long**	.02 x D	3 x D	0	0	.05 x D	3 x D	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Material Type	Bhn	Cutting Diameter 1/8		3/16		1/4		5/16		3/8		1/2		5/8		3/4		1	
		rpm	in/min	rpm	in/min	rpm	in/min	rpm	in/min	rpm	in/min	rpm	in/min	rpm	in/min	rpm	in/min	rpm	in/min
Low Carbon Steels	~175	20,935	50	13,960	60	10,465	70	8,375	70	6,980	70	5,235	60	4,185	60	3,490	60	2,615	55
Low Carbon Steels	~275	18,320	35	12,225	40	9,160	50	7,335	50	6,110	50	4,580	45	3,665	45	3,055	45	2,290	40
Med Alloy Steels	~275	15,265	30	10,185	35	7,635	40	6,110	40	5,090	40	3,815	40	3,055	40	2,545	40	1,910	35
Mold And Die Steels	~275	13,750	25	9,170	30	6,875	35	5,500	35	4,585	35	3,440	35	2,750	35	2,290	35	1,720	30
Cast Iron - Gray	~200	11,765	35	7,845	40	5,880	40	4,705	40	3,920	40	2,940	40	2,355	35	1,960	35	1,470	30
Cast Iron - Ductile	~300	10,545	20	7,030	25	5,270	25	4,215	25	3,515	25	2,635	25	2,110	25	1,755	25	1,320	20
Cast Iron - Malleable	~300	6,570	10	4,380	15	3,285	15	2,630	15	2,190	15	1,645	15	1,315	15	1,095	15	820	10
Stainless 300 Series	~275	10,695	15	7,130	20	5,350	25	4,280	25	3,565	25	2,675	25	2,140	25	1,785	25	1,335	20
Stainless 400 Series	~185	15,265	30	10,185	40	7,635	45	6,110	45	5,090	45	3,815	45	3,055	45	2,545	45	1,910	40
Stainless PH Series	~325	9,160	10	6,110	15	4,580	20	3,665	20	3,055	20	2,290	20	1,830	20	1,525	20	1,145	15
Titanium Alloys	~295	11,460	25	7,640	30	5,730	35	4,585	35	3,820	35	2,865	35	2,290	35	1,910	35	1,435	30
High Temp. Alloys	~300	3,055	6	2,035	7	1,530	8	1,220	8	1,020	8	765	8	610	8	510	8	380	7

Rates shown are for finish milling. When performing an alternate cut, multiply the speed and feed rates shown by the correction factors SpC and FeC.
*Available in diameters 1/4, 5/16, 3/8, 7/16, 1/2, 5/8, and 3/4
V-Carbs are not intended for plunging. Recommendations are a starting point. Some adjustments may be required.

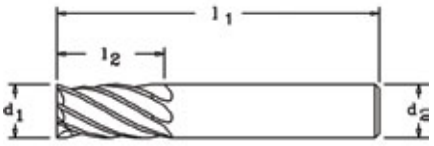


Radial Width of Cut **(Rw)**
Axial Depth of Cut **(Ad)**
Tool Diameter **(D)**
Speed Correction Factor **(SpC)**
Feed Correction Factor **(FeC)**

V-CARB™ - Series 55M - Metric - 5 Flute End Mills With Square Corner

Metric

Cutting Diameter d_1	Length of Cut l_2	Overall Length l_1	Shank Diameter d_2	Ti-NAMITE-A (AlTiN) EDP No.	Ti-NAMITE-A (AlTiN w/Flat) EDP No.
6	12	50	6	42606	
6	19	63	6	42607	
6	25	75	6	42608	
8	12	50	8	42609	
8	20	63	8	42610	
8	25	75	8	42611	
10	16	50	10	42612	
10	22	75	10	42622	42613
10	38	100	10	42614	
12	19	63	12	42615	
12	25	75	12	42616	42623
12	50	100	12	42617	
16	32	89	16	42618	42624
16	75	150	16	42619	
20	38	100	20	42620	42625
20	75	150	20	42621	



Tolerances (mm)		
Diameter	d1	d2
6-20	+0,000 / -0,050	+0,0025 / -0,010

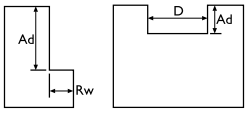
V-CARB™ - Series 55M - Metric

Speed and Feed Recommendations

	Finishing★★★★				Semi-Finishing★★★				Heavy Peripheral★★				Slotting★			
	Rw	Ad	SpC	FeC	Rw	Ad	SpC	FeC	Rw	Ad	SpC	FeC	Rw	Ad	SpC	FeC
*Stub	.05 x D	LOC	0	0	.1 x D	LOC	.8	1.2	.5 x D	1.25 x D	.6	.35	1 x D	.7 x D	.5	.30
Reg	.05 x D	LOC	0	0	.1 x D	LOC	.8	1.2	.5 x D	1 x D	.6	.35	1 x D	.5 x D	.5	.30
Long	.02 x D	3 x D	0	0	.05 x D	3 x D	0	0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

		Cutting Diameter											
Material Type	Bhn	6		8		10		12		16		20	
		rpm	mm/min	rpm	mm/min	rpm	mm/min	rpm	mm/min	rpm	mm/min	rpm	mm/min
Low Carbon Steels	~175	11,080	1,780	8,310	1,780	6,645	1,780	5,540	1,525	4,155	1,525	3,325	1,525
Low Carbon Steels	~275	9,705	1,270	7,275	1,270	5,820	1,270	4,855	1,145	3,640	1,145	2,910	1,145
Med Alloy Steels	~275	8,085	1,015	6,065	1,015	4,850	1,015	4,045	1,015	3,035	1,015	2,425	1,015
Mold And Die Steels	~275	7,280	890	5,460	890	4,365	890	3,640	890	2,730	890	2,185	890
Cast Iron - Gray	~200	6,230	1,015	4,670	1,015	3,735	1,015	3,115	1,015	2,335	1,015	1,870	1,015
Cast Iron - Ductile	~300	5,580	635	4,185	635	3,350	635	2,790	635	2,095	635	1,675	635
Cast Iron - Malleable	~300	3,480	380	2,610	380	2,085	380	1,740	380	1,305	380	1,045	380
Stainless 300 Series	~275	5,660	635	4,245	635	3,395	635	2,830	635	2,125	635	1,700	635
Stainless 400 Series	~185	8,085	1,145	6,065	1,145	4,850	1,145	4,045	1,145	3,035	1,145	2,425	1,145
Stainless PH Series	~325	4,850	510	3,640	510	2,910	510	2,425	510	1,820	510	1,455	510
Titanium Alloys	~295	6,065	890	4,550	890	3,640	890	3,030	890	2,275	890	1,820	890
High Temp. Alloys	~300	1,615	205	1,215	205	970	205	810	205	610	205	485	205

Rates shown are for finish milling. When performing an alternate cut, multiply the speed and feed rates shown by the correction factors SpC and FeC.
*Available in diameters 6, 8, 10, and 12
V-Carbs are not intended for plunging. Recommendations are a starting point. Some adjustments may be required.



Radial Width of Cut **(Rw)**
Axial Depth of Cut **(Ad)**
Tool Diameter **(D)**
Speed Correction Factor **(SpC)**
Feed Correction Factor **(FeC)**

TRI-CARB®

High Performance Carbide End Mills

Improved productivity in Milling Stainless Steel, Nickel, and Titanium Alloys

Approaching High-Strength and Heat Resisting Materials

Heat resisting alloys and stainless steels are designed to perform in the most demanding conditions and provide mechanical strength, corrosion resistance and oxidation resistance. The performance factors designed into these materials contribute to the difficulties encountered in machining. Titanium alloys also have a much lower modulus producing tool deflection and machining problems.

To effectively machine these materials, SGS has developed a tool to overcome the mechanical resistance of the metal and the heat generated in the deformation and frictional wear between the metal and the tool.

The SGS Tri-Carb®, manufactured from lab-certified carbide, has been designed to provide twice the amount of shear available from conventional end mills to overcome the strength, work hardening and high impact resistance of these metals. The amount of heat produced cutting these alloys requires an effective high temperature coating barrier between the metal and the tool. Tri-Carb® is designed with Ti-NAMITE-A (AlTiN), the most effective coating in resisting high temperature conditions and the galling nature of these alloys.

Benefits

- Increased Productivity
- Improved Surface Finish
- Longer Tool Life
- Reduced Need For Coolant
- More Accurate Cutting

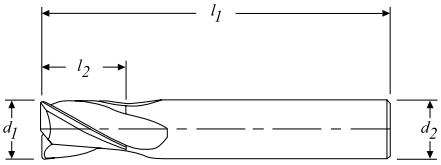
Features

- Optional Shank Neck
- Faced Hook
- High Hardness
- Stub Length
- Enhanced Corner Strength
- Application Specific Carbide
- Corner Radius
- Ti-NAMITE-A (AlTiN) Coated
- Stub Length
- Maximum Rigidity
- High Shear
- Geometry
- High Transverse Rupture Strength

Fractional

Tri-CARB® - Series 65 -
3 Flute - Fractional - End Mill

Cutting Diameter d_1	Length of Cut l_2	Overall Length l_1	Shank Diameter d_2	Corner Radius	Ti-NAMITE A (AlTiN) EDP No.
1/8	1/4	1-1/2	1/8	.010	91200
3/16	5/16	2	3/16	.010	91201
1/4	3/8	2-1/2	1/4	.010	91202
5/16	7/16	2-1/2	5/16	.010	91203
3/8	1/2	2-1/2	3/8	.011	91204
1/2	5/8	3	1/2	.015	91205
5/8	3/4	3-1/2	5/8	.019	91206
3/4	1	4	3/4	.023	91207
1	1-1/4	4	1	.030	91208

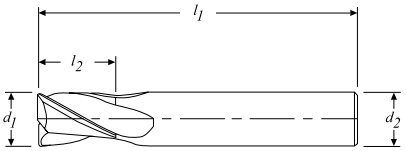


Tolerances (inch)		
Diameter	d_1	d_2
1/8 – 1	+.000/–.002	–.0001/–.0004
Corner Radius: +.000/–.002		

Metric

Tri-CARB® - Series 65M -
3 Flute - Metric - End Mill

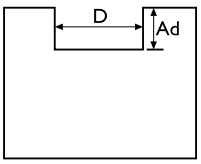
Cutting Diameter d_1	Length of Cut l_2	Overall Length l_1	Shank Diameter d_2	Corner Radius	Ti-NAMITE A (AlTiN) EDP No.
3	6	38	3	0,25	91300
4	8	50	4	0,25	91301
5	8	50	6	0,25	91302
6	9	63	6	0,25	91303
8	11	63	8	0,25	91304
10	13	69	10	0,30	91305
12	15	75	12	0,36	91306
16	19	89	16	0,48	91307
20	26	100	20	0,61	91308



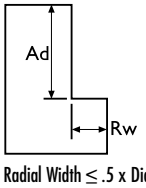
Tolerances (mm)		
Diameter	d_1	d_2
3 – 6	+0,00/–0,03	+0,00/–0,01
> 6 – 10	+0,00/–0,04	+0,00/–0,01
> 10 – 20	+0,00/–0,05	+0,00/–0,01
Corner Radius: +0,00/–0,05		

Speed and Feed Recommendations

Diameter (D)		Alloy Steel ≤ 275 Bhn 350 sfm 105 m / min		Titanium ≤ 300 Bhn 300 sfm 90 m / min		Inconel ≤ 300 Bhn 80 sfm 24 m / min		Stainless ≤ 275 Bhn 300 sfm 90 m / min	
		Feed Rate – Per Tooth							
in	mm	in	mm	in	mm	in	mm	in	mm
1/8	3	.0004	.010	.0003	.007	.0002	.005	.0003	.007
	4		.015		.010		.007		.010
3/16	5	.0009	.023	.0005	.013	.0004	.010	.0004	.013
1/4	6	.0012	.030	.0009	.023	.0006	.015	.0006	.018
5/16	8	.0014	.035	.0012	.030	.0010	.025	.0009	.025
3/8	10	.0018	.045	.0015	.038	.0012	.030	.0011	.033
1/2	12	.0023	.058	.0019	.048	.0016	.040	.0017	.043
5/8	16	.0026	.066	.0024	.060	.0020	.050	.0022	.055
3/4	20	.0029	.073	.0026	.066	.0024	.060	.0025	.064
1		.0032	.081	.0035	.088	.0025	.064	.0033	.084



Axial Depth ≤ .5 x Diameter



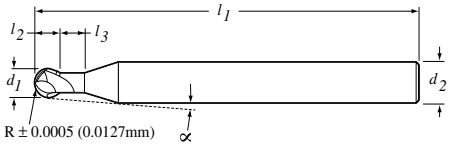
Radial Width ≤ .5 x Diameter
Axial Depth ≤ 1 x Diameter

rpm = sfm x 3.82 / tool diameter
rpm = (m/min x 1000) / (3.14 x tool diameter)
feed per minute = feed per tooth x no. of teeth x rpm

Turbo-Carb®
HIGH PERFORMANCE CARBIDE END MILLS

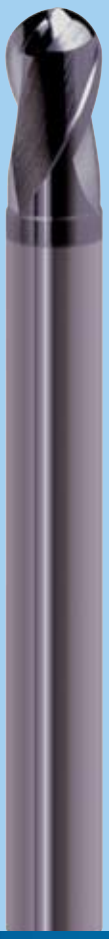
Solid Carbide High Performance End Mills for machining complex, contour shapes in tough and hardened mold & die steels.

- Designed for high speed rough and finish milling of mold and die steels up to 60 Rc
- Application specific carbide improves wear resistance and toughness
- Ti-NAMITE-A (AlTiN) coated for maximum heat and wear resistance
- Helical ball gashing for improved shearing action
- Extended reach capability
- Rigid construction



Suggestions for using Turbo-Carb® End Mills

- Pressurized air with oil extends tool life in materials <40 Rc
- Use dry air when finish milling or roughing materials harder than 40 Rc
- Flood coolant is not recommended
- The Z-level cutting method and climb milling extend tool life in roughing applications
- Helical interpolation is the preferred entry method. Avoid direct plunging
- Attention to programming details, tool holders, TIR, & balance contribute to additional tool life
- Speed and feed recommendations are based on using the tool tip



Fractional

Turbo-Carb® - Series 56B - 2 Flute - Ball End - Extended Reach

Cutting Diameter d_1	Length of Cut l_2	Overall Length l_1	Shank Diameter d_2	α	Neck l_3	Ti-NAMITE-A (AlTiN) EDP No.
1/32	1/32	3	1/4	8° 20′	1/32	93272
1/16	1/16	3	1/4	7° 40′	1/16	93273
3/32	3/32	3	1/4	6° 50′	3/32	93274
1/8	1/8	3	1/4	6°	1/8	93275
3/16	3/16	3	1/4	3° 35′	3/16	93276
1/4	1/4	3 1/2	1/4	–	1/4	93277
5/16	5/16	4	5/16	–	5/16	93278
3/8	3/8	4	3/8	–	3/8	93279
1/2	1/2	4 1/2	1/2	–	1/2	93280
5/8	5/8	5 1/2	5/8	–	5/8	93281
3/4	3/4	6 1/2	3/4	–	3/4	93282

Tolerances (inch)

Diameter	d_1	d_2
1/32 – 3/32	+.0000/–.0010	–.0001/–.0003
> 3/32 – 1/4	+.0000/–.0012	–.0001/–.0003
> 1/4 – 3/8	+.0000/–.0016	–.0001/–.0003
> 3/8 – 3/4	+.0000/–.0020	–.0001/–.0004

Metric

Turbo-Carb® - Series 56MB - 2 Flute - Ball End - Extended Reach

Cutting Diameter d_1 mm	Length of Cut l_2 mm	Overall Length l_1 mm	Shank Diameter d_2 mm	α	Neck l_3 mm	Ti-NAMITE-A (AlTiN) EDP No.
1	1	76	6	8° 10′	1	91349
1.5	1.5	76	6	7° 45′	1.5	91350
2	2	76	6	7° 10′	2	91351
2.5	2.5	76	6	6° 35′	2.5	91352
3	3	76	6	6°	3	91353
4	4	76	6	4° 30′	4	91354
5	5	89	6	2° 30′	5	91355
6	6	89	6	–	6	91356
8	8	102	8	–	8	91357
10	10	102	10	–	10	91358
12	12	114	12	–	12	91359
16	16	140	16	–	16	91360
20	20	165	20	–	20	91361

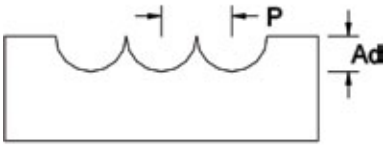
Tolerances (mm)

Diameter	d_1	d_2
1 – 2.5	+0,000/–0,025	–0,0025/–0,0075
> 2.5 – 6	+0,000/–0,030	–0,0025/–0,0075
> 6 – 10	+0,000/–0,040	–0,0025/–0,0075
> 10 – 20	+0,000/–0,050	–0,0025/–0,0100

Roughing - Fractional

Diameter	Steels < 40 Rc Ad = 10% dia Axial Depth[1]	rpm[2]	Feed / Tooth	Steels > 40 - 50 Rc Ad = 5% dia Axial Depth[1]	rpm[2]	Feed / Tooth	Steels > 50 - 60 Rc Ad = 4% dia Axial Depth[1]	rpm[2]	Feed / Tooth
1/32	.0031	76,740	.0006	.0016	90,200	.0005	.0013	61,270	.0004
1/16	.0063	38,065	.0015	.0031	45,745	.0011	.0025	31,190	.0008
3/32	.0094	25,430	.0020	.0047	30,335	.0015	.0038	20,655	.0011
1/8	.0125	19,100	.0030	.0063	22,700	.0023	.0050	15,595	.0017
3/16	.0188	12,720	.0040	.0094	15,170	.0030	.0075	10,395	.0023
1/4	.0250	9,550	.0050	.0125	11,395	.0038	.0100	7,800	.0029
5/16	.0313	7,635	.0060	.0156	9,120	.0050	.0125	6,240	.0038
3/8	.0375	6,365	.0080	.0188	7,585	.0060	.0150	5,200	.0045
1/2	.0500	4,775	.0100	.0250	5,695	.0075	.0200	3,900	.0057
5/8	.0625	3,820	.0110	.0312	4,560	.0080	.0250	3,120	.0060
3/4	.0750	3,185	.0120	.0375	3,800	.0085	.0300	2,600	.0063

P (pitch) = up to 40% of dia



FORMULAS – FRACTIONAL

sfm = rpm x .262 x cutting diameter

rpm = sfm x 3.82 / cutting diameter

feed (inches / minute) = feed per tooth x number of teeth x rpm

cusp height* = (tool diameter / 2) - $\sqrt{\text{tool diameter}^2 - \text{pitch}^2}$ / 4

pitch = $\sqrt{4 \times (\text{cusp height} \times \text{tool diameter}) - 4 \times (\text{cusp height}^2)}$

Finishing - Fractional

Diameter	Steels < 40 Rc Ad = 3% dia Axial Depth[1]	rpm[2]	Feed / Tooth	Steels > 40 - 50 Rc Ad = 2% dia Axial Depth[1]	rpm[2]	Feed / Tooth	Steels > 50 - 60 Rc Ad = 1% dia Axial Depth[1]	rpm[2]	Feed / Tooth
1/32	.0010	116,925	.0007	.0006	144,870	.0006	.0003	125,465	.0005
1/16	.0019	58,370	.0017	.0013	69,595	.0012	.0006	62,680	.0009
3/32	.0030	38,890	.0022	.0019	46,975	.0017	.0010	39,655	.0012
1/8	.0040	29,185	.0033	.0025	35,470	.0025	.0013	30,125	.0019
3/16	.0060	19,455	.0044	.0038	23,495	.0033	.0019	20,340	.0025
1/4	.0075	14,590	.0055	.0050	17,735	.0042	.0025	15,355	.0032
5/16	.0095	11,675	.0066	.0063	14,135	.0055	.0031	12,335	.0042
3/8	.0110	9,730	.0088	.0075	11,825	.0066	.0038	10,170	.0050
1/2	.0150	7,295	.0110	.0100	8,870	.0082	.0050	7,680	.0063
5/8	.0200	5,835	.0120	.0125	7,095	.0090	.0063	6,120	.0067
3/4	.0230	4,865	.0130	.0150	5,645	.0100	.0075	5,120	.0071

P (pitch) = dependent on finish requirement (see formulas)

* on flat surface

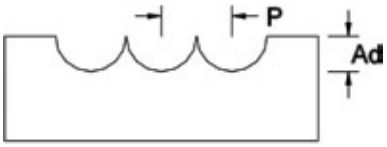
[1] suggested maximum

[2] if recommendation exceeds your machine limit use the maximum available

Roughing - Metric

Diameter	Steels < 40 Rc Ad = 10% dia Axial Depth[1]	rpm[2]	Feed / Tooth	Steels > 40 - 50 Rc Ad = 5% dia Axial Depth[1]	rpm[2]	Feed / Tooth	Steels > 50 - 60 Rc Ad = 4% dia Axial Depth[1]	rpm[2]	Feed / Tooth
1	.10	60,640	.015	.05	72,285	.015	.04	49,485	.010
1.5	.15	40,400	.030	.08	48,155	.025	.06	32,965	.020
2	.20	30,335	.045	.10	36,160	.035	.08	24,755	.025
2.5	.25	24,265	.050	.13	28,920	.040	.10	19,800	.030
3	.30	20,215	.075	.15	24,100	.055	.12	16,495	.045
4	.40	15,160	.095	.20	18,070	.065	.16	12,370	.050
5	.50	12,125	.100	.25	14,455	.075	.20	9,895	.060
6	.60	10,110	.125	.30	12,050	.095	.24	8,250	.075
8	.80	7,580	.150	.40	9,035	.125	.32	6,185	.095
10	1.0	6,065	.205	.50	7,230	.150	.40	4,950	.115
12	1.2	5,055	.255	.60	6,025	.190	.48	4,125	.145
16	1.6	3,790	.280	.80	4,520	.200	.64	3,095	.150
20	2.0	3,030	.300	1.0	3,615	.215	.80	2,475	.160

P (pitch) = up to 40% of dia



FORMULAS – METRIC

m / min = (3.14 x cutting diameter x rpm) / 1000

rpm = (1000 x m / min) / (3.14 x cutting diameter)

feed (mm / minute) = feed per tooth x number of teeth x rpm

cusp height* = (tool diameter / 2) - $\sqrt{\text{tool diameter}^2 - \text{pitch}^2}$ / 4

pitch = $\sqrt{4 \times (\text{cusp height} \times \text{tool diameter}) - 4 \times (\text{cusp height}^2)}$

Finishing - Metric

Diameter	Steels < 40 Rc Ad = 3% dia Axial Depth[1]	rpm[2]	Feed / Tooth	Steels > 40 - 50 Rc Ad = 2% dia Axial Depth[1]	rpm[2]	Feed / Tooth	Steels > 50 - 60 Rc Ad = 1% dia Axial Depth[1]	rpm[2]	Feed / Tooth
1	.03	92,660	.020	.02	112,555	.020	.010	97,030	.010
1.5	.05	61,730	.045	.03	74,980	.030	.015	64,635	.025
2	.06	46,355	.050	.04	56,305	.040	.020	48,540	.030
2.5	.08	37,075	.055	.05	45,035	.045	.025	38,820	.040
3	.09	30,890	.085	.06	37,520	.065	.030	32,345	.050
4	.12	23,165	.100	.08	28,135	.075	.040	24,255	.060
5	.15	18,530	.110	.10	22,505	.085	.050	19,400	.065
6	.18	15,445	.140	.12	18,760	.105	.060	16,175	.080
8	.24	11,580	.170	.16	14,065	.140	.080	12,125	.105
10	.30	9,265	.225	.20	11,255	.170	.100	9,700	.130
12	.36	7,720	.280	.24	9,380	.210	.120	8,085	.160
16	.48	5,790	.305	.32	7,035	.230	.160	6,065	.170
20	.60	4,635	.320	.40	5,630	.255	.200	4,850	.180

P (pitch) = dependent on finish requirement (see formulas)

* on flat surface

[1] suggested maximum

[2] if recommendation exceeds your machine limit use the maximum available

Power-Carb™

HIGH PERFORMANCE CARBIDE END MILLS

Maximize your Milling Performance of Mold Grade Steels up to 65 HRc

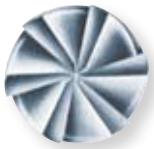
FEATURES/BENEFITS

- Exceptionally strong geometry for:
  - slot and finish milling applications
  - improved surface finishes
  - high feed rates
- Ti-NAMITE-A® (AlTiN) coated for maximum heat and wear resistance
- Engineered carbide provides maximum hardness and fracture resistance
- Long reach capabilities
- Wet or dry machining
- High speed or conventional machining

ADDITIONAL BENEFITS OF DRY MILLING ARE:

- Eliminates procurement costs for cutting fluids*
- Eliminates coolant disposal costs
- Reduces chip disposal costs
- Reduces cutting fluid related health issues (stricter standards have been proposed)

** Research shows coolants to be 17% of manufacturing costs*



Superior Performance in High Temperature Applications

The chemical composition of aluminum titanium nitride (AlTiN) maximizes heat and wear resistance, making it most suitable for wet or dry milling in hardened steels, and many other applications.

Power-Carb® Design Features

Eccentric Relief / Extreme Negative Radial Rake: These features significantly increase edge strength, and are especially critical when finish milling hard materials. Without exceptional strength, edges are prone to chip.

Engineered Carbide: This material is specifically designed for difficult machining operations.

High Helix / Multi-Edge Design: Multiple cutting edges increase rigidity and feed rate capabilities, while the 45 degree helix angle increases shearing ability without sacrificing edge strength. The combination of these features improves surface finishes by reducing cutter deflection and maintaining a more consistent cutter-to-workpiece contact.

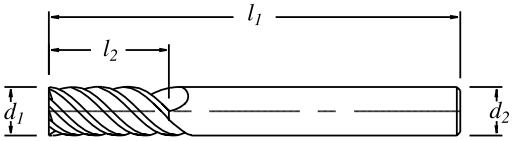
Long Reach: Power-Carbs® are manufactured with extra long shanks for extended reach capabilities.

Advantages of Dry Milling

Extensive testing has shown that elimination of flood coolant often prolongs tool life. Milling applications in hardened steels generate extremely high temperatures and the rapid quenching of conventional flood coolant can produce thermal shock, which reduces tool life. Semi-cooling and chip removal with air and oil blast stabilizes tool temperatures. Dry milling does require an effective heat resistant coating. Ti-NAMITE-A® provides this required protection and is a standard feature of the Power-Carb® end mill.

	Ti-NAMITE-A® (AlTiN)	(TiN)
Vickers Hardness (HV)	3000-3500	2300-3000
Oxidation Temperature	800° C 1472° F	600° C 1112° F

Fractional

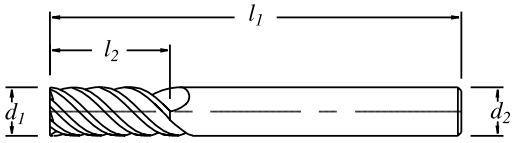


Power-Carb™ - Series 57 - 6 Flute - End Mill

Cutting Diameter d_1	Length of Cut l_2	Overall Length l_1	Shank Diameter d_2	Ti-NAMITE-A (AlTiN) EDP No.
1/4	17/32	3.5	1/4	36140
5/16	11/16	4.0	5/16	36141
3/8	13/16	4.0	3/8	36142
1/2	1 3/32	4.5	1/2	36143

Tolerances (inch)		
Diameter	d1	d2
1/4	+.0000 / -.0012	-.0001 / -.0003
5/16	+.0000 / -.0016	-.0001 / -.0003
3/8	+.0000 / -.0016	-.0001 / -.0003
1/2	+.0000 / -.0020	-.0001 / -.0004

Metric



Power-Carb™ - Series 57M - 6 Flute - End Mill

Cutting Diameter d_1	Length of Cut l_2	Overall Length l_1	Shank Diameter d_2	Ti-NAMITE-A (AlTiN) EDP No.
6	13	89	6	46140
8	18	102	8	46141
10	22	102	10	46142
12	26	114	12	46143

Tolerances (mm)		
Diameter	d1	d2
6	+0,000 / -0,030	-0,0025 /-0,0075
8	+0,000 / -0,040	-0,0025 / -0,0075
10	+0,000 / -0,040	-0,0025 /-0,0075
12	+0,000 / -0,050	-0,0025 /-0,0100

POWER-CARB® HIGH PERFORMANCE CARBIDE END MILLS

PERFORMANCE DATA:

Milling D2 / (DIN 1.2379 / X 155 CrMoV 12 1) @ 58 HRc

TOOL USED:

.394" (10 mm)

CUTTING CONDITIONS:

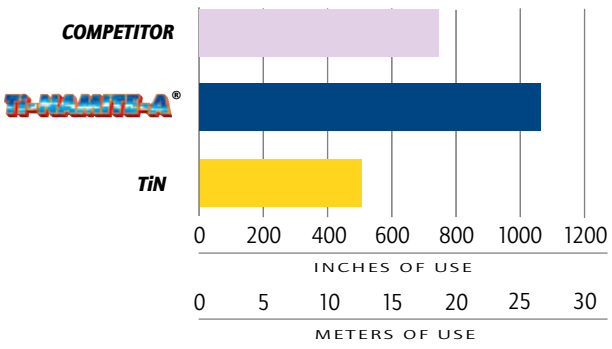
.472" (12mm) axial depth x .020" (0.5mm) radial width

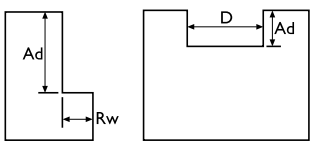
COOLING METHOD:

Air / Oil

TOOL SPEED / FEED RATE:

2384 rpm / 45 ipm (1143 mm/min)





Radial Width of Cut (Rw)
Axial Depth of Cut (Ad)

Power-Carb™
HIGH PERFORMANCE CARBIDE END MILLS

Power-Carb Speed and Feed Recommendations

Slotting		Steels 30-45 Rc		Steels 45-55 Rc		Steels 55-60 Rc		Steels 60-65 Rc	
		Rw 1 x D Ad ≤.3 x D		Rw 1 x D Ad ≤.2 x D		Rw 1 x D Ad ≤.1 x D		Rw 1 x D Ad ≤.1 x D	
		Speed		Speed		Speed		Speed	
		215 sfm	65 m / min	145 sfm	45 m / min	100 sfm	30 m / min	65 sfm	20 m / min
Diameter (D)		Feed per Tooth		Feed per Tooth		Feed per Tooth		Feed per Tooth	
in	mm	in	mm	in	mm	in	mm	in	mm
1/4	6	.0014	.035	.0013	.033	.0012	.030	.0011	.028
5/16	8	.0016	.040	.0015	.040	.0014	.035	.0012	.030
3/8	10	.0020	.050	.0018	.045	.0016	.040	.0014	.035
1/2	12	.0024	.060	.0022	.055	.0020	.050	.0018	.045

Profiling		Steels 30-45 Rc		Steels 45-55 Rc		Steels 55-60 Rc		Steels 60-65 Rc	
		Rw ≤.1 x D Ad ≤1.5 x D		Rw ≤.05 x D Ad ≤1.5 x D		Rw ≤.05 x D Ad ≤1.5 x D		Rw ≤.05 x D Ad ≤1.5 x D	
		Speed		Speed		Speed		Speed	
		330 sfm	100 m / min	300 sfm	90 m / min	260 sfm	80 m / min	200 sfm	60 m / min
Diameter (D)		Feed per Tooth		Feed per Tooth		Feed per Tooth		Feed per Tooth	
in	mm	in	mm	in	mm	in	mm	in	mm
1/4	6	.0018	.045	.0015	.040	.0014	.035	.0012	.030
5/16	8	.0022	.055	.0020	.050	.0018	.045	.0015	.040
3/8	10	.0024	.065	.0024	.060	.0022	.055	.0020	.050
1/2	12	.0030	.075	.0027	.070	.0026	.065	.0024	.060

High Speed Profiling		Steels 30-45 Rc		Steels 45-55 Rc		Steels 55-60 Rc		Steels 60-65 Rc	
		Rw ≤.04 x D Ad ≤1.5 x D		Rw ≤.04 x D Ad ≤1.5 x D		Rw ≤.01 x D Ad ≤1.5 x D		Rw ≤.01 x D Ad ≤1.5 x D	
		Speed		Speed		Speed		Speed	
		825 sfm	250 m / min	825 sfm	250 m / min	425 sfm	130 m / min	425 sfm	130 m / min
Diameter (D)		Feed per Tooth		Feed per Tooth		Feed per Tooth		Feed per Tooth	
in	mm	in	mm	in	mm	in	mm	in	mm
1/4	6	.0040	.100	.0035	.090	.0030	.070	.0025	.060
5/16	8	.0045	.110	.0040	.100	.0035	.090	.0030	.070
3/8	10	.0050	.130	.0047	.120	.0040	.100	.0035	.090
1/2	12	.0055	.140	.0050	.130	.0047	.120	.0045	.110

The Original High Performance End Mill for Aluminum

Design Features

Circular Land – One of the unique features of the SGS Ski-Carb® end mill design is the polished circular land. Tight control of the circular land width reduces edge aggressiveness, which allows the user to vary speed and feed rates, as well as mill into corners without inducing the chatter typical to conventional tools.

Ski-Land – Another unique feature of the SGS Ski-Carb® end mill is the primary/secondary flute wall construction. Ski-Land is beneficial in avoiding chip interference by directing the chip away from the secondary flute.

High-Helix – The 45 degree helix angle increases effective rake for greater shearing ability without reducing edge strength. It also helps elevate the chip up and away from the work area.

Stub Length – The SGS Ski-Carb® is available in short flute lengths for increased rigidity in the most demanding rouging applications.

Corner Radii – The entire SGS Ski-Carb® line is available with a corner radius to provide additional protection against chipping.

Versatility of SGS Ski-Carb®

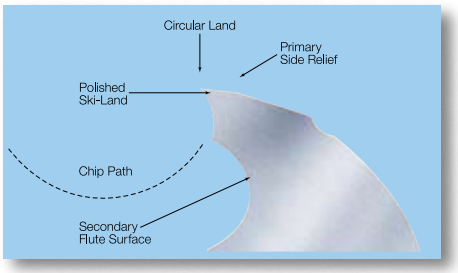
The SGS Ski-Carb® end mills have been proven winners for rough and finish milling applications in aluminum, plastic and other nonferrous and non-metallic materials. The combination of unique patented* features, blended with available options, provides customers with unsurpassed versatility, making the purchase of several tools unnecessary to complete the job.

The SGS Ski-Carb® offers the following enhancements: stub lengths for increased rigidity in the most demanding applications; corner radius geometry for additional protection against chipping; neck options on stub length shanks for extended reach capabilities; and, set screw flats.

A wider range of feeds and speeds are possible with the exclusive SGS Ski-Carb® design to increase your production rates and improve your productivity. The SGS Ski-Carb® end mills give you clean, easy shearing action for chatter-free work finishes, better workpiece tolerances, and significantly longer tool life.

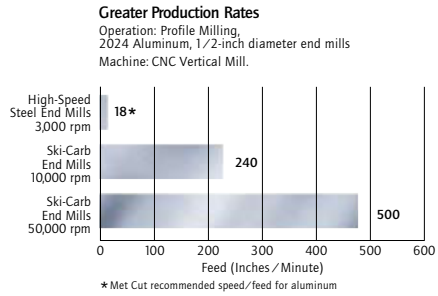
Features/Benefits

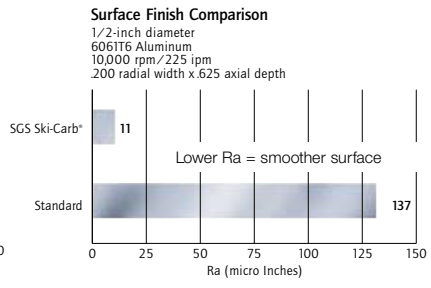
- Patented Design Offers:
  - High Feed Capability
  - Superior Surface Finishing
  - Chatter Free Operation
- Utilizes Maximum Spindle Speeds
  - Proven Performance at 50,000 rpm
- One-Step Roughing and Finishing
- Stub Lengths for Greater Rigidity
- Popular Corner Radius Sizes
- Neck & Flat Options



*U.S. Patent No. 5,049,009

SKI-CARB® End Mills Performance Data





Roughing and Finishing Operations with a Single Pass – SGS Ski-Carb® provides a surface finish better than a finishing tool with the metal removal rates of a roughing tool!

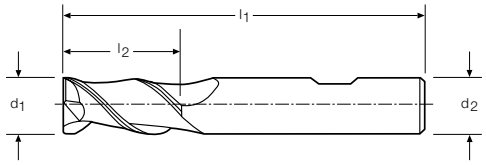
SGS SKI-CARB®

Fractional

SKI-CARB® - Series 44
2 Flute - Standard Lengths - Fractional - End Mill

Cutting Diameter d_1	Length of Cut l_2	Overall Length l_1	Shank Diameter d_2	Radius* (Optional)	Uncoated EDP No. w/Flat	Uncoated EDP No. w/o Flat
1/4	3/4	2-7/16	3/8	.015-.060	34501	32033
1/4	1-1/4	3-1/16	3/8	.015-.060	34503	32034
1/4	1-3/4	3-9/16	3/8	.015-.060	34505	32035
5/16	1-3/8	3-1/8	3/8	.015-.060	34507	32036
3/8	3/4	2-1/2	3/8	.015-.060	34509	32037
3/8	1-1/2	3-1/4	3/8	.015-.060	34511	32038
3/8	2-1/2	4-1/4	3/8	.015-.060	34513	32039
1/2	1-1/4	3-1/4	1/2	.015-.125	34515	32040
1/2	2	4	1/2	.015-.125	34517	32041
1/2	3	5	1/2	.015-.125	34519	32042
5/8	1-5/8	3-3/4	5/8	.015-.125	34521	32043
5/8	2-1/2	4-5/8	5/8	.015-.125	34523	32044
3/4	1-5/8	3-7/8	3/4	.015-.125	34525	32045
3/4	3	5-1/4	3/4	.015-.125	34527	32046
3/4	4	6-1/4	3/4	.015-.125	34529	32047
1	2	4-1/2	1	.015-.125	34531	32048
1	4	6-1/2	1	.015-.125	34533	32049

*Contact your SGS Sales Representative for more information on Corner Radius Options.

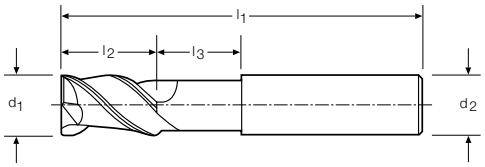


Tolerances (inch)		
Diameter	d_1	d_2
1/4 – 1	+.0000/–.0005	–.0001/–.0004
Corner Radius: +.000/–.002		

SKI-CARB® - Series 45
2 Flute - Stub Lengths - Fractional - End Mill

Cutting Diameter d_1	Length of Cut l_2	Overall Length l_1	Neck* (Optional) l_3	Shank Diameter d_2	Radius	Uncoated EDP No. w/Flat	Uncoated EDP No. w/o Flat
1/4	3/8	2-1/2	9/16	3/8	.010	91257	91250
5/16	7/16	2-1/2	5/8	3/8	.012	91258	91251
3/8	9/16	2-1/2	9/16	3/8	.015	91259	91252
1/2	3/4	3	3/4	1/2	.020	91260	91253
5/8	7/8	3-1/2	7/8	5/8	.025	91261	91254
3/4	1	4	1	3/4	.030	91262	91255
1	1-1/4	4	7/8	1	.040	91263	91256

*Contact your SGS Sales Representative for more information on Neck Options.

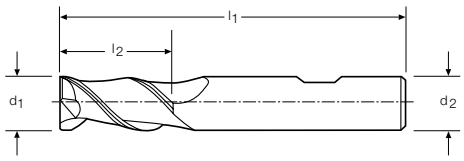


Metric

SKI-CARB® - Series 44M
2 Flute -Standard Lengths - Metric - End Mill

Cutting Diameter d_1 h_6 mm	Length of Cut l_2 mm	Overall Length l_1 mm	Shank Diameter d_2 h_6 mm	Radius* (Optional) mm	Uncoated EDP No. w/Flat	Uncoated EDP No. w/o Flat
3	8	52	6	0,38-0,76	44505	49663
4	11	55	6	0,38-0,76	44509	49664
5	13	57	6	0,38-0,76	44513	49665
6	13	57	6	0,38-1,52	44517	49666
8	19	69	10	0,38-1,52	44521	49667
10	22	72	10	0,38-1,52	44525	49668
12	26	83	12	0,38-3,17	44529	49669
14	26	83	14	0,38-3,17	44533	49670
16	32	92	16	0,38-3,17	44537	49671
18	32	92	18	0,38-3,17	44541	49672
20	38	104	20	0,38-3,17	44545	49673

*Contact your SGS Sales Representative for more information on Corner Radius Options.



Tolerances (mm)		
Diameter	d_1	d_2
1 – 3	+0,000/–0,006	+0,000/–0,006
> 3 – 6	+0,000/–0,008	+0,000/–0,008
> 6 – 10	+0,000/–0,009	+0,000/–0,009
> 10 – 18	+0,000/–0,011	+0,000/–0,011
> 18 – 20	+0,000/–0,013	+0,000/–0,013
Corner Radius: +0,00/–0,05		

Speed and Feed Recommendations
RPM – Use Maximum Available – No speed limits for SGS Ski-Carb®

Recommendations:

- Increase feed based on motor load
- Adjust feed appropriately when finish milling
- Use sufficient coolant, particularly in aluminum applications
- Mist may be advantageous when milling deep pockets
- For optimum performance balance holder/tool assembly

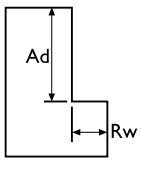
Contact SGS Tool Company for re-sharpening information.

		Aluminum Alloys		Plastics		Copper Alloys		Brass/Bronze	
Diameter (D)		1600-2000 sfm 490-610 m/min		1200-1600 sfm 365-490 m/min		800-1200 sfm 245-365 m/min		800-1500 sfm 245-455 m/min	
		Feed Rate Per Tooth							
in	mm	in	mm	in	mm	in	mm	in	mm
	3		.04		.08		.04		.04
	4		.05		.10		.05		.05
	5		.06		.12		.06		.06
1/4	6	.003	.07	.006	.14	.003	.07	.003	.07
5/16	8	.004	.10	.008	.20	.004	.10	.004	.10
3/8	10	.005	.12	.010	.24	.005	.12	.005	.12
1/2	12	.006	.15	.012	.30	.006	.15	.006	.15
	14		.17		.34		.17		.17
5/8	16	.007	.18	.014	.36	.007	.18	.007	.18
	18		.20		.40		.20		.20
3/4	20	.008	.22	.016	.44	.008	.22	.008	.22
1		.010		.018		.010		.010	

The above are recommended starting points for regular orstub flute length mills – adjust feed accordingly for extra-long flute lengths

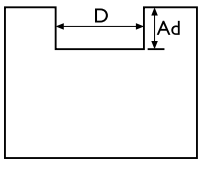
Profiling

Axial Depth (Ad) ≤ 1.5 x D
Radial Width ≤ (Rw) .5 x D



Slotting

Axial Depth (Ad) ≤ 1 x D



rpm = sfm x 3.82 / tool diameter

rpm = (m/min x 1000) / (3.14 x tool diameter)

feed per minute = feed per tooth x no. of teeth x rpm

CARB
Solid Carbide End Mills for Aluminum

S-Carb Series 47 Features & Benefits

Chatter Free Operation

- Improves Material Removal Rates
- Improves Surface Finishes

Low Cutting Force

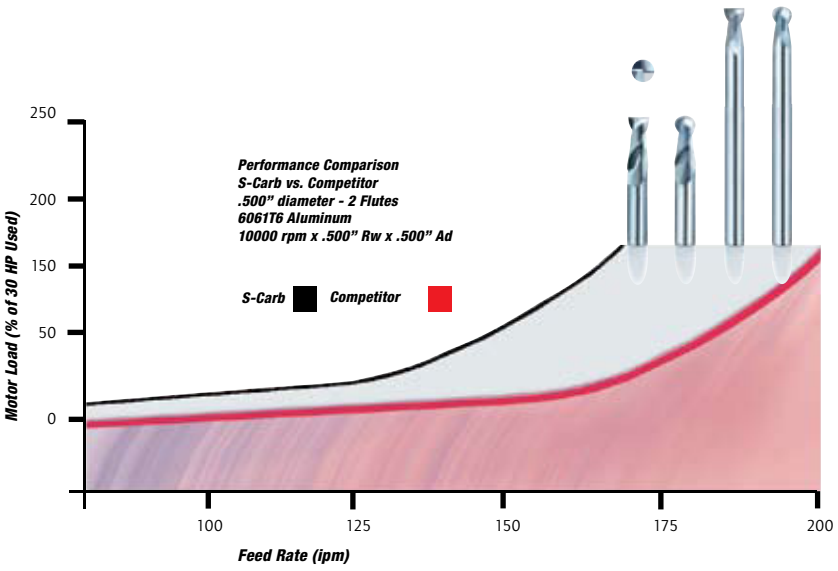
- Permits Higher Feed Rates
- Increases Tool Life

Selection of Styles

- Regular Length, Square and Ball End
- Extended Reach, Square and Ball End
- Fractional and Metric Sizes

Suitable for Non-Ferrous/Non Metallic Materials

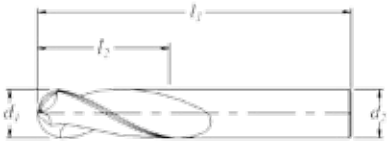
- Aluminum Alloys
- Plastics
- Copper
- Brass/Bronze



CARB
Solid Carbide End Mills for Aluminum

S-CARB 2 Flute Solid Carbide End Mills for Aluminum

Fractional

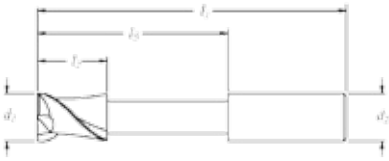


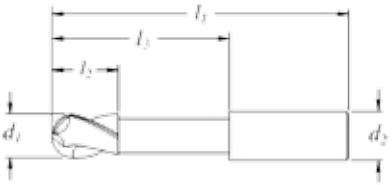
Series 47 Fractional Regular Length Square End

Cutting Diameter d1	Length of Cut l2	Overall Length l1	Shank Diameter d2	Uncoated EDP Number
1/8	3/8	1-1/2	1/8	34620
3/16	9/16	2	3/16	34621
1/4	3/4	2-1/2	1/4	34622
5/16	13/16	2-1/2	5/16	34623
3/8	1	2-1/2	3/8	34624
1/2	1-1/4	3-1/4	1/2	34625
5/8	1-5/8	3-3/4	5/8	34626
3/4	1-5/8	4	3/4	34627
1	2	4-1/2	1	34628

Series 47B Fractional Regular Length Ball End

Cutting Diameter d1	Length of Cut l2	Overall Length l1	Shank Diameter d2	Uncoated EDP Number
1/8	3/8	1-1/2	1/8	34630
3/16	9/16	2	3/16	34631
1/4	3/4	2-1/2	1/4	34632
5/16	13/16	2-1/2	5/16	34633
3/8	1	2-1/2	3/8	34634
1/2	1-1/4	3-1/4	1/2	34635
5/8	1-5/8	3-3/4	5/8	34636
3/4	1-5/8	4	3/4	34637
1	2	4-1/2	1	34638





Series 47ES Fractional Extended Reach Square End

Cutting Diameter d1	Length of Cut l2	Overall Length l1	Shank Diameter d2	Reach l3	Uncoated EDP Number
1/4	3/8	4	1/4	2-1/8	34640
3/8	1/2	4	3/8	2-1/8	34641
1/2	5/8	6	1/2	2-1/8	34642
1/2	5/8	6	1/2	3-3/8	34643
5/8	3/4	6	5/8	2-3/8	34644
5/8	3/4	6	5/8	3-3/8	34645
3/4	1	6	3/4	2-1/2	34646
3/4	1	6	3/4	3-3/8	34647

Series 47EB Fractional Extended Reach Ball End

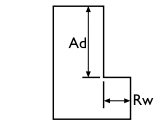
Cutting Diameter d1	Length of Cut l2	Overall Length l1	Shank Diameter d2	Reach l3	Uncoated EDP Number
1/4	3/8	4	1/4	2-1/8	34650
3/8	1/2	4	3/8	2-1/8	34651
1/2	5/8	6	1/2	2-1/8	34652
1/2	5/8	6	1/2	3-3/8	34653
5/8	3/4	6	5/8	2-3/8	34654
5/8	3/4	6	5/8	3-3/8	34655
3/4	1	6	3/4	2-1/2	34656
3/4	1	6	3/4	3-3/8	34657

Tolerances (inch)		
Diameter	d_1	d_2
1/8 – 1	–.0001/–.0004	–.0001/–.0004

Speed and Feed Recommendations - Fractional - Regular Length

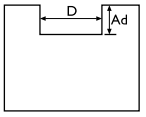
Aluminum Alloys	Plastics	Copper Alloys	Brass / Bronze
1600-2000 sfm 490-610 m/min	1200-1600 sfm 365-490 m/min	800-1200 sfm 245-365 m/min	800-1500 sfm 245-455 m/min

Diameter (D)		Feed Rate Per Tooth							
in	mm	in	mm	in	mm	in	mm	in	mm
1/8	3	.0015	.04	.0030	.08	.0015	.04	.0015	.04
	4		.05		.10		.05		.05
3/16	5	.0025	.06	.0050	.12	.0025	.06	.0025	.06
1/4	6	.0030	.07	.0060	.14	.003	.07	.003	.07
5/16	8	.0040	.10	.0080	.20	.004	.10	.004	.10
3/8	10	.0050	.12	.0100	.24	.005	.12	.005	.12
1/2	12	.0060	.15	.0120	.30	.006	.15	.006	.15
	14		.17		.34		.17		.17
5/8	16	.0070	.18	.0140	.36	.007	.18	.007	.18
3/4	20	.0080	.22	.0160	.44	.008	.22	.008	.22
1	25	.0100		.0180		.010		.010	



Axial Depth
(Ad) ≤ 1.5 x D

Radial Width
(Rw) ≤ .5 x D



Axial Depth
(Ad) ≤ 1 x D

rpm = sfm x 3.82 / tool diameter
rpm = (m/min x 1000) / (3.14 x tool diameter)

feed per minute = feed per tooth x no. of teeth x rpm

Speed and Feed Recommendations - Fractional - Long Reach

Aluminum

	Slotting		Peripheral		Contouring	
	Roughing	Finishing	Roughing	Finishing	Roughing	Finishing
Radial Width (Rw)	1xD	1xD	.25xD	.05xD	.3xD	.04xD
Axial Depth (Ad)	.5xD	.05xD	1xD	.8xD	.3xD	.05xD
Speed (sfm)	2000	2000	2000	2000	2000	2000

Feed / Tooth by Diameter (inch)

	1/4		3/8		1/2-5/8		3/4	
Operation	Roughing	Finishing	Roughing	Finishing	Roughing	Finishing	Roughing	Finishing
Slotting	.0016	.0020	.0035	.0040	.0045	.0055	.0070	.0085
Peripheral	.0020	.0028	.0040	.0045	.0055	.0070	.0085	.0100
Contouring	.0024	.0040	.0045	.0060	.0070	.0080	.0100	.0120

Copper Alloys

	Slotting		Peripheral		Contouring	
	Roughing	Finishing	Roughing	Finishing	Roughing	Finishing
Radial Width (Rw)	1xD	1xD	.25xD	.05xD	.1xD	.04xD
Axial Depth (Ad)	.1xD	.05xD	1xD	.8xD	.2xD	.05xD
Speed (sfm)	400	400	400	400	600	600

Feed / Tooth by Diameter (inch)

	1/4		3/8		1/2-5/8		3/4	
Operation	Roughing	Finishing	Roughing	Finishing	Roughing	Finishing	Roughing	Finishing
Slotting	.0010	.0015	.0016	.0020	.0035	.0040	.0045	.0055
Peripheral	.0015	.0020	.0020	.0028	.0040	.0045	.0055	.0070
Contouring	.0020	.0025	.0024	.0040	.0045	.0060	.0070	.0080

Plastics

	Slotting		Peripheral		Contouring	
	Roughing	Finishing	Roughing	Finishing	Roughing	Finishing
Radial Width (Rw)	1xD	1xD	.25xD	.05xD	.3xD	.04xD
Axial Depth (Ad)	.5xD	.05xD	1xD	.8xD	.3xD	.05xD
Speed (sfm)	280	325	350	400	400	450

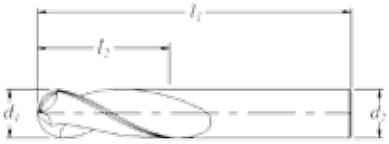
Feed / Tooth by Diameter (inch)

	1/4		3/8		1/2-5/8		3/4	
Operation	Roughing	Finishing	Roughing	Finishing	Roughing	Finishing	Roughing	Finishing
Slotting	.0010	.0015	.0016	.0020	.0035	.0040	.0045	.0055
Peripheral	.0015	.0020	.0020	.0028	.0040	.0045	.0055	.0070
Contouring	.0020	.0025	.0024	.0040	.0045	.0060	.0070	.0080

CARB
Solid Carbide End Mills for Aluminum

S-CARB 2 Flute Solid Carbide End Mills for Aluminum

Metric

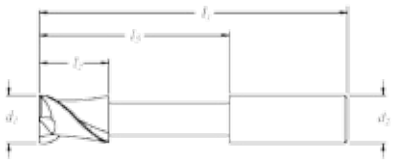


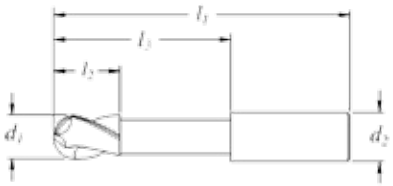
Series 47M Metric Regular Length Square End

Cutting Diameter d1 mm	Length of Cut l2 mm	Overall Length l1 mm	Shank Diameter d2 mm	Uncoated EDP Number
3	8	38	3	44550
4	11	50	4	44551
5	13	50	5	44552
6	13	57	6	44553
8	19	63	8	44554
10	22	72	10	44555
12	26	83	12	44556
14	26	83	14	44557
16	32	92	16	44558
20	38	104	20	44559
25	44	104	25	44560

Series 47MB Metric Regular Length Ball End

Cutting Diameter d1 mm	Length of Cut l2 mm	Overall Length l1 mm	Shank Diameter d2 mm	Uncoated EDP Number
3	8	38	3	44570
4	11	50	4	44571
5	13	50	5	44572
6	13	57	6	44573
8	19	63	8	44574
10	22	72	10	44575
12	26	83	12	44576
14	26	83	14	44577
16	32	92	16	44578
20	38	104	20	44579
25	44	104	25	44580





Series 47MES Metric Extended Reach Square End

Cutting Diameter d1 mm	Length of Cut l2 mm	Overall Length l1 mm	Shank Diameter d2 mm	Reach l3 mm	Uncoated EDP Number
6	10	100	6	54	44561
8	12	100	8	54	44562
10	12	100	10	54	44563
12	16	150	12	80	44564
16	20	150	16	80	44565
20	25	150	20	80	44566

Series 47MEB Metric Extended Reach Ball End

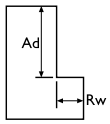
Cutting Diameter d1 mm	Length of Cut l2 mm	Overall Length l1 mm	Shank Diameter d2 mm	Reach l3 mm	Uncoated EDP Number
6	10	100	6	54	44581
8	12	100	8	54	44582
10	12	100	10	54	44583
12	16	150	12	80	44584
16	20	150	16	80	44585
20	25	150	20	80	44586

Tolerances (mm)		
Diameter	d_1	d_2
3-25	–0,0025/–0,010	–0,0025/–0,010

Speed and Feed Recommendations - Metric - Regular Length

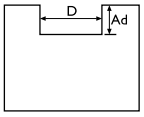
	Aluminum Alloys	Plastics	Copper Alloys	Brass / Bronze
	1600-2000 sfm 490-610 m/min	1200-1600 sfm 365-490 m/min	800-1200 sfm 245-365 m/min	800-1500 sfm 245-455 m/min

Diameter (D)		Feed Rate Per Tooth							
in	mm	in	mm	in	mm	in	mm	in	mm
1/8	3	.0015	.04	.0030	.08	.0015	.04	.0015	.04
	4		.05		.10		.05		.05
3/16	5	.0025	.06	.0050	.12	.0025	.06	.0025	.06
1/4	6	.0030	.07	.0060	.14	.003	.07	.003	.07
5/16	8	.0040	.10	.0080	.20	.004	.10	.004	.10
3/8	10	.0050	.12	.0100	.24	.005	.12	.005	.12
1/2	12	.0060	.15	.0120	.30	.006	.15	.006	.15
	14		.17		.34		.17		.17
5/8	16	.0070	.18	.0140	.36	.007	.18	.007	.18
3/4	20	.0080	.22	.0160	.44	.008	.22	.008	.22
1	25	.0100		.0180		.010		.010	



Axial Depth
(Ad) ≤ 1.5 x D

Radial Width
(Rw) ≤ .5 x D



Axial Depth
(Ad) ≤ 1 x D

rpm = sfm x 3.82 / tool diameter
rpm = (m/min x 1000) / (3.14 x tool diameter)

feed per minute = feed per tooth x no. of teeth x rpm

Speed and Feed Recommendations - Metric - Long Reach

Aluminum

	Slotting		Peripheral		Contouring	
	Roughing	Finishing	Roughing	Finishing	Roughing	Finishing
Radial Width (Rw)	1xD	1xD	.25xD	.05xD	.3xD	.04xD
Axial Depth (Ad)	.5xD	.05xD	1xD	.8xD	.3xD	.05xD
Speed (m/min)	610	610	610	610	610	610

Feed / Tooth by Diameter (mm)

	6		8-10		12-16		20	
Operation	Roughing	Finishing	Roughing	Finishing	Roughing	Finishing	Roughing	Finishing
Slotting	0.040	0.050	0.090	0.100	0.110	0.140	0.180	0.215
Peripheral	0.050	0.070	0.100	0.110	0.140	0.180	0.215	0.250
Contouring	0.060	0.100	0.110	0.150	0.180	0.200	0.250	0.300

Copper Alloys

	Slotting		Peripheral		Contouring	
	Roughing	Finishing	Roughing	Finishing	Roughing	Finishing
Radial Width (Rw)	1xD	1xD	.25xD	.05xD	.1xD	.04xD
Axial Depth (Ad)	.1xD	.05xD	1xD	.8xD	.2xD	.05xD
Speed (m/min)	400	400	400	400	610	610

Feed / Tooth by Diameter (mm)

	6		8-10		12-16		20	
Operation	Roughing	Finishing	Roughing	Finishing	Roughing	Finishing	Roughing	Finishing
Slotting	0.025	0.035	0.040	0.050	0.090	0.100	0.110	0.140
Peripheral	0.035	0.050	0.050	0.070	0.100	0.110	0.140	0.170
Contouring	0.050	0.065	0.060	0.100	0.110	0.150	0.170	0.200

Plastics

	Slotting		Peripheral		Contouring	
	Roughing	Finishing	Roughing	Finishing	Roughing	Finishing
Radial Width (Rw)	1xD	1xD	.25xD	.05xD	.3xD	.04xD
Axial Depth (Ad)	.5xD	.05xD	1xD	.8xD	.3xD	.05xD
Speed (m/min)	275	320	350	400	400	460

Feed / Tooth by Diameter (mm)

	6		8-10		12-16		20	
Operation	Roughing	Finishing	Roughing	Finishing	Roughing	Finishing	Roughing	Finishing
Slotting	0.025	0.035	0.040	0.050	0.090	0.100	0.110	0.140
Peripheral	0.035	0.050	0.050	0.070	0.100	0.110	0.140	0.170
Contouring	0.050	0.065	0.060	0.100	0.110	0.150	0.170	0.200

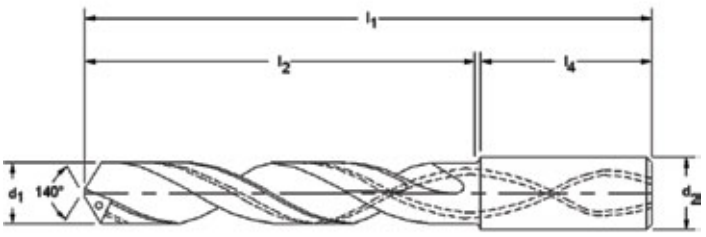
IC-Carb
High Performance Internal Coolant Drills

ICe-Carb High Performance Internal Coolant Drills for Drilling Depths up to 7xD

- Drilling Depths up to 7xD: Eliminates the need for pecking in most applications
- Internal Coolant for achieving higher cutting parameters and greater chip control
- 140 degree Self-Centering Point Angle
- Unique geometry features that enhance coolant flow and chip removal
- Corner protection added for increased tool life
- Ti-NAMITE®-A (AlTiN) coated for higher thermal stability and greater wear resistance in deep hole drilling
- Excellent results in:
  - Stainless Steel
  - Alloyed Steel
  - Cast Iron
  - Low Carbon Steel
  - Tool Steel
  - Inconel
  - Titanium

Series 140M Drill Tolerances - mm

Diameter d_1	Tolerance d_1 (m7)	d_2 (h6)
≤ 3	+0,002 / +0,012	+0,0000 / -0,008
> 3 - 6	+0,004 / +0,016	+0,0000 / -0,008
> 6 - 10	+0,006 / +0,021	+0,0000 / -0,009
>10 - 18	+0,007 / +0,025	+0,0000 / -0,011

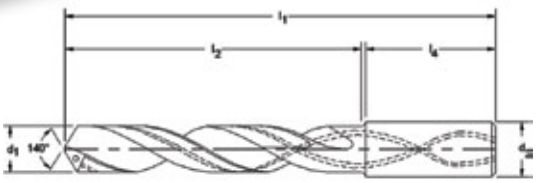


Metric

ICe-Carb Series 140M IC Internal Coolant Through Drills 7x Diameter

d1 Cutting Diameter mm	Ti-NAMITE-A (AlTiN) EDP No.	Tap Size Reference Only	Tap Size Reference Only	Decimal Equivalent	d2 Shank Diameter mm	l1 Overall Length mm	l2 Flute Length mm	l4 Shank Length mm
3	63575			.1181	6	75	37,5	36
3,1	63576			.1220	6	75	37,5	36
3,2	63577		M3.5 X.35	.1260	6	75	37,5	36
3,3	63578		M4	.1299	6	75	37,5	36
3,4	63579	#8-32		.1339	6	75	37,5	36
3,5	63580	#8-36	M4 X .5	.1378	6	75	37,5	36
3,6	63581		M4 X .35	.1417	6	75	37,5	36
3,7	63582		M4.5	.1457	6	75	37,5	36
3,8	63583	#10-24		.1496	6	75	37,5	36
3,9	63584			.1535	6	75	37,5	36
4	63585		M4.5 X .5	.1575	6	75	37,5	36
4,1	63586	#10-32		.1614	6	75	37,5	36
4,2	63587		M5 / M5 X .75	.1654	6	75	37,5	36
4,3	63588			.1693	6	85	45	36
4,4	63589	#12-24		.1732	6	85	45	36
4,5	63590		M5 X .5	.1772	6	85	45	36
4,6	63591	#12-28		.1811	6	85	45	36
4,7	63592			.1850	6	85	45	36
4,8	63593			.1890	6	90	50	36
4,9	63594			.1929	6	90	50	36
5	63595		M6	.1969	6	90	50	36
5,1	63596	1/4-20		.2008	6	90	50	36
5,2	63597		M6 X .75	.2047	6	90	50	36
5,3	63598			.2087	6	90	50	36
5,4	63599			.2126	6	97	57	36
5,5	63600	1/4-28	M6 X .5	.2165	6	97	57	36
5,6	63601			.2205	6	97	57	36
5,7	63602			.2244	6	97	57	36
5,8	63603			.2283	6	97	57	36
5,9	63604			.2323	6	97	57	36
6	63605		M7	.2362	6	97	57	36
6,1	63606			.2402	8	106	66	36
6,2	63607		M7 X .75	.2441	8	106	66	36
6,3	63608			.2480	8	106	66	36
6,4	63609			.2520	8	106	66	36
6,5	63610			.2559	8	106	66	36
6,6	63611	5/16-18		.2598	8	106	66	36
6,7	63612			.2638	8	106	66	36
6,8	63613		M8	.2677	8	106	66	36
6,9	63614	5/16-24		.2717	8	116	76	36
7	63615		M8 X 1	.2756	8	116	76	36
7,1	63616			.2795	8	116	76	36
7,2	63617		M8 X .75	.2835	8	116	76	36
7,3	63618			.2874	8	116	76	36
7,4	63619			.2913	8	116	76	36
7,5	63620		M8 X .5	.2953	8	116	76	36
7,6	63621			.2992	8	116	76	36
7,7	63622			.3031	8	116	76	36
7,8	63623		M9	.3071	8	116	76	36
7,9	63624			.3110	8	116	76	36
8	63625	3/8-16	M9 X 1	.3150	8	116	76	36
8,1	63626			.3189	10	131	87	40
8,2	63627			.3228	10	131	87	40
8,3	63628			.3268	10	131	87	40

continued on page 38



Series 140M Drill Tolerances - mm

Diameter d_1	Tolerance d_1 (m7)	Tolerance d_2 (h6)
≤ 3	+0,002 / +0,012	+0,0000 / -0,008
> 3 - 6	+0,004 / +0,016	+0,0000 / -0,008
> 6 - 10	+0,006 / +0,021	+0,0000 / -0,009
>10 - 18	+0,007 / +0,025	+0,0000 / -0,011

Metric

ICe-Carb Series 140M IC Internal Coolant Through Drills 7x Diameter

d1 Cutting Diameter mm	Ti-NAMITE-A (AlTiN) EDP No.	Tap Size Reference Only	Tap Size Reference Only	Decimal Equivalent	d2 Shank Diameter mm	l1 Overall Length mm	l2 Flute Length mm	l4 Shank Length mm
8,4	63629			.3307	10	131	87	40
8,5	63630	3/8-24	M10	.3346	10	131	87	40
8,6	63631			.3386	10	131	87	40
8,7	63632			.3425	10	131	87	40
8,8	63633		M10 X 1.25	.3465	10	131	87	40
8,9	63634			.3504	10	131	87	40
9	63635		M10 X 1	.3543	10	131	87	40
9,1	63636			.3583	10	139	95	40
9,2	63637		M10 X .75	.3622	10	139	95	40
9,3	63638	7/16-14		.3661	10	139	95	40
9,4	63639			.3701	10	139	95	40
9,5	63640		M11 / M10 X .5	.3740	10	139	95	40
9,6	63641			.3780	10	139	95	40
9,7	63642			.3819	10	139	95	40
9,8	63643			.3858	10	139	95	40
9,9	63644	7/16-20		.3898	10	139	95	40
10	63645			.3937	10	139	95	40
10,1	63646			.3976	12	155	106	45
10,2	63647		M12	.4016	12	155	106	45
10,3	63648			.4055	12	155	106	45
10,4	63649			.4094	12	155	106	45
10,5	63650		M12 X 1.5	.4134	12	155	106	45
10,6	63651			.4173	12	155	106	45
10,7	63652	1/2-13		.4213	12	155	106	45
10,8	63653		M12 X 1.25	.4252	12	155	106	45
10,9	63654			.4291	12	155	106	45

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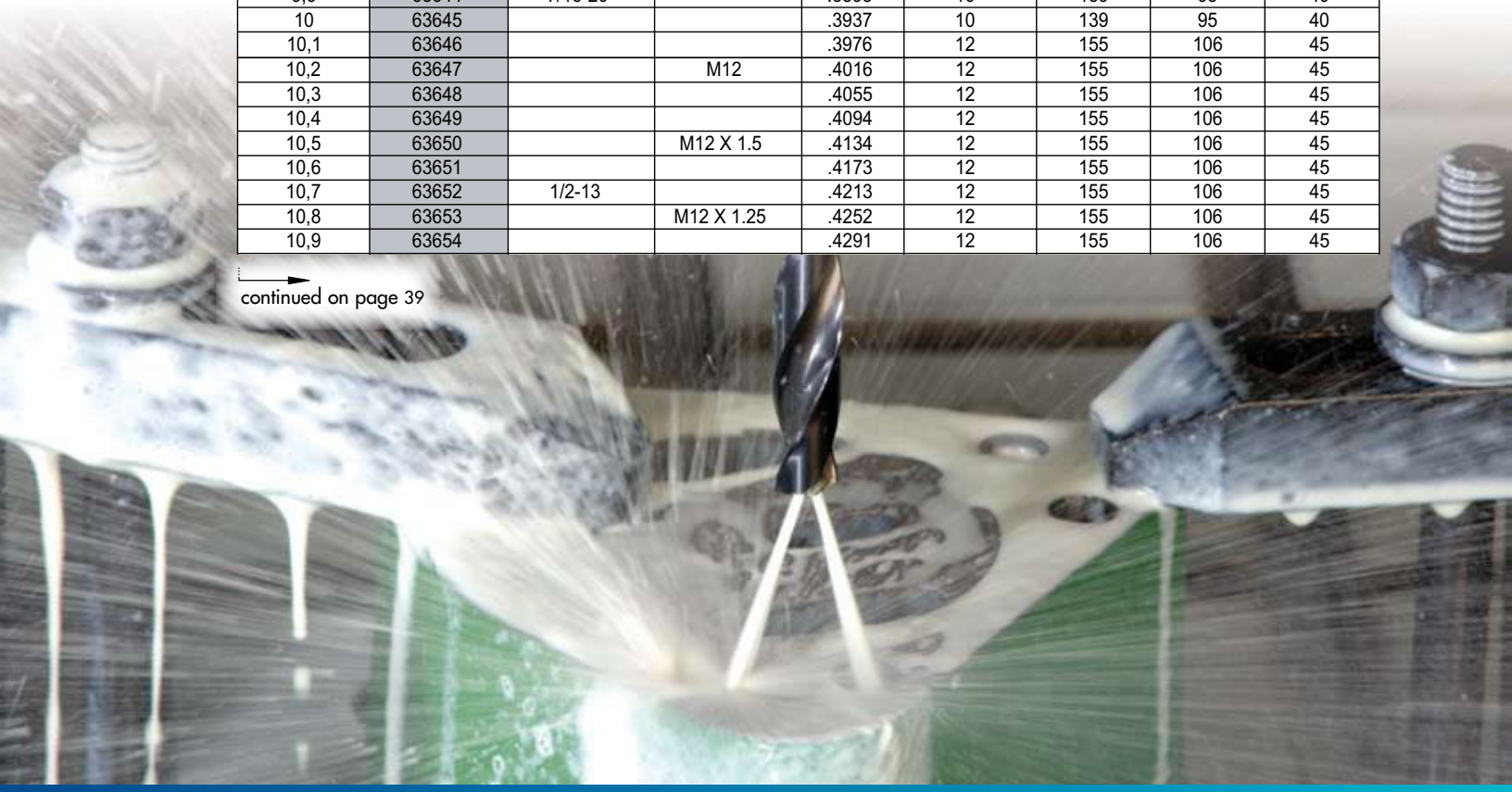


Metric

ICe-Carb Series 140M IC Internal Coolant Through Drills 7x Diameter

d1 Cutting Diameter mm	Ti-NAMITE-A (AlTiN) EDP No.	Tap Size Reference Only	Tap Size Reference Only	Decimal Equivalent	d2 Shank Diameter mm	l1 Overall Length mm	l2 Flute Length mm	l4 Shank Length mm
11	63655		M12 X 1	.4331	12	155	106	45
11,1	63656			.4370	12	163	114	45
11,2	63657			.4409	12	163	114	45
11,3	63658			.4449	12	163	114	45
11,4	63659			.4488	12	163	114	45
11,5	63660	1/2-20	M12 X .5	.4528	12	163	114	45
11,6	63661			.4567	12	163	114	45
11,7	63662			.4606	12	163	114	45
11,8	63663			.4646	12	163	114	45
11,9	63664			.4685	12	163	114	45
12	63665		M14	.4724	12	163	114	45
12,5	63666		M14 X 1.5	.4921	14	182	133	45
12,8	63667		M14 X 1.25	.5039	14	182	133	45
13	63668	9/16-18	M14 X 1	.5118	14	182	133	45
13,5	63669	5/8-11		.5315	14	182	133	45
13,8	63670			.5433	14	182	133	45
14	63671		M16	.5512	14	182	133	45
14,5	63672	5/8-18	M16 X 1.5	.5709	16	204	152	48
14,8	63673			.5827	16	204	152	48
15	63674		M16 X 1	.5906	16	204	152	48
15,5	63675		M18	.6102	16	204	152	48
15,8	63676			.6220	16	204	152	48
16	63677			.6299	16	204	152	48

Series 140M Speed and Feed Recommendations

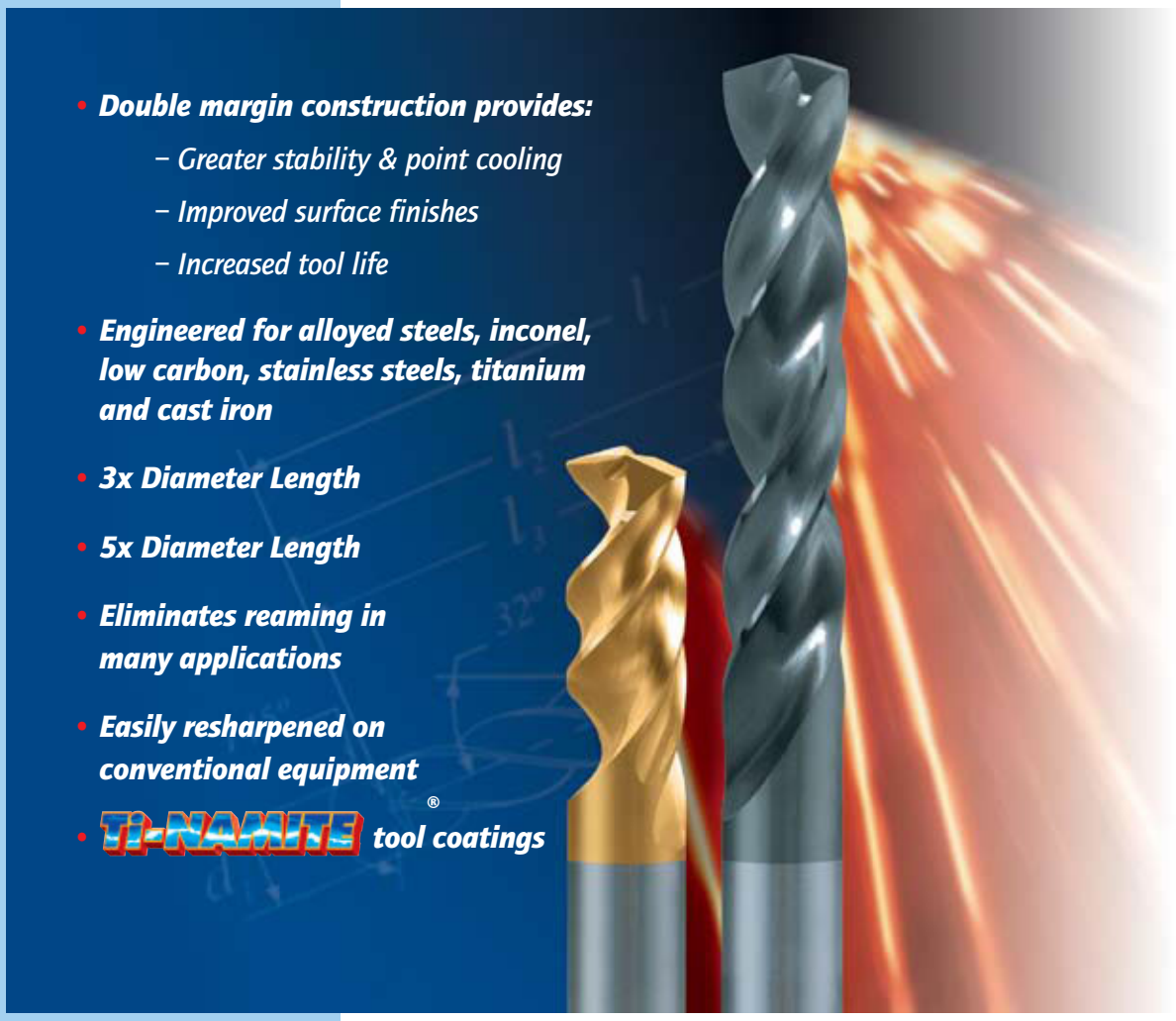
material	hardness		speed		drill diameter			
					3 – 5 mm (.118 – .197 in.)	>5 – 8 mm (.203 – .316 in.)	>8 – 12 mm (.328 – .500 in.)	>12 – 16 mm (.512 – .640 in.)
classification	Bhn	Rc	sfm	m / min	feed / revolution			
low carbon steel 1018	≤ 170	≤ 5	450	135	.10 – .15 (.004 – .006)	.15 – .25 (.006 – .010)	.25 – .40 (.010 – .016)	.40 – .50 (.016 – .020)
alloyed steel 4140	≤ 270	≤ 28	300	90	.075 – .12 (.003 – .005)	.12 – .20 (.005 – .008)	.20 – .30 (.008 – .012)	.30 – .40 (.012 – .016)
high strength steel 4340, 300M	≤ 400	≤ 43	190	60	.05 – .10 (.002 – .004)	.10 – .15 (.004 – .006)	.15 – .23 (.006 – .009)	.23 – .30 (.009 – .012)
tool steel H-13	≤ 170	≤ 5	230	70	.05 – .10 (.002 – .004)	.10 – .18 (.004 – .007)	.18 – .25 (.007 – .010)	.25 – .33 (.010 – .013)
cast iron	150-200	1-15	400	120	.12 – .20 (.005 – .008)	.20 – .33 (.008 – .013)	.33 – .50 (.013 – .020)	.50 – .65 (.020 – .026)
	200-300	15-30	245	75	.10 – .18 (.004 – .007)	.18 – .28 (.007 – .011)	.28 – .43 (.011 – .017)	.43 – .55 (.017 – .022)
	300-400	30-45	190	60	.075 – .15 (.003 – .006)	.15 – .25 (.006 – .010)	.25 – .38 (.010 – .015)	.38 – .50 (.015 – .020)
stainless steel 316, 17-4PH, 15-5PH	≤ 225	≤ 20	140	45	.050 – .075 (.002 – .003)	.075 – .120 (.003 – .005)	.12 – .20 (.005 – .008)	.20 – .25 (.008 – .010)
stainless steel 304, 410, 420	≤ 170	≤ 5	180	55	.075 – .10 (.003 – .004)	.10 – .15 (.004 – .006)	.15 – .25 (.006 – .010)	.25 – .33 (.010 – .013)
titanium 6Al4V	≤ 380	≤ 40	100	30	.050 – .075 (.002 – .003)	.075 – .10 (.003 – .004)	.10 – .15 (.004 – .006)	.15 – .20 (.006 – .008)
high temp alloys Inconel 718	≤ 400	≤ 43	50	15	.025 – .050 (.001 – .002)	.050 – .075 (.002 – .003)	.075 – .10 (.003 – .004)	.10 – .12 (.004 – .005)

Resharpening service available upon request.

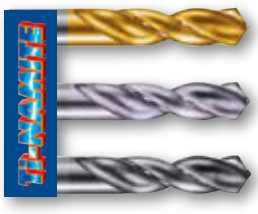
HI-PERCARB®

HIGH PERFORMANCE CARBIDE DRILLS

Increase production rates up to 12 times over conventional carbide drills

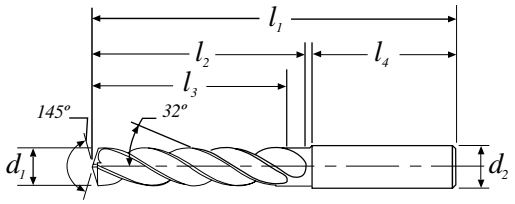


- **Double margin construction provides:**
  - *Greater stability & point cooling*
  - *Improved surface finishes*
  - *Increased tool life*
- **Engineered for alloyed steels, inconel, low carbon, stainless steels, titanium and cast iron**
- **3x Diameter Length**
- **5x Diameter Length**
- **Eliminates reaming in many applications**
- **Easily resharpened on conventional equipment**
- **Ti-NAMITE® tool coatings**



- **Ti-NAMITE (TiN)**– *Recommended for general purpose applications in low and medium carbon steels.*
- **Ti-NAMITE-C (TiCN)**– *Recommended for applications in titanium alloys and alloyed steels.*
- **Ti-NAMITE-A (AlTiN)**– *Recommended for applications in cast iron, high temperature alloys, and stainless steels.*

Wire • Letter - HI-PERCARB® - Series 135



Fractional

Cutting Diameter d_1	Decimal Equivalent	Tap Size Reference Only	Shank Diameter d_2	Overall Length l_1	Flute Length l_2	Min. Cleared Length l_3	Min. Shank Length l_4	Ti-NAMITE (TiN) EDP No.	Ti-NAMITE-C (TiCN) EDP No.	Ti-NAMITE-A (AlTiN) EDP No.
1/32	.0312		1/8	1 1/2	1/4	5/32	1	51247	51258	51269
3/64	.0469	1/16 - 64	1/8	1 1/2	3/8	1/4	1	51248	51259	51270
1/16	.0625	5/64 - 60	1/8	2	7/16	9/32	1 1/4	51249	51260	51271
5/64	.0781		1/8	2	1/2	11/32	1 1/4	51250	51261	51272
3/32	.0938	1/8 - 32	1/8	2	1/2	11/32	1 1/4	51251	51262	51273
40	.0980		1/8	2	9/16	3/8	1 1/4	51252	51263	51274
7/64	.1094		1/8	2	5/8	13/32	1 1/4	51253	51264	51275
35	.1100		1/8	2	5/8	13/32	1 1/4	51254	51265	51276
34	.1110		1/8	2	5/8	13/32	1 1/4	51255	51266	51277
1/8	.1250		1/4	2-1/2	3/4	1/2	1-7/16	51280	51380	51330
30	.1285		1/4	2 1/2	3/4	1/2	1 7/16	51256	51267	51278
29	.1360	8-32,8-36	1/4	2-1/2	3/4	1/2	1-7/16	51281	51381	51331
9/64	.1406		1/4	2-1/2	3/4	1/2	1-7/16	51282	51382	51332
25	.1495	10-24	1/4	2-5/8	7/8	9/16	1-7/16	51283	51383	51333
5/32	.1562		1/4	2-5/8	7/8	9/16	1-7/16	51284	51384	51334
21	.1590	10-32	1/4	2-5/8	7/8	9/16	1-7/16	51285	51385	51335
20	.1610	13/64 - 24	1/4	2 5/8	7/8	9/16	1 7/16	51257	51268	51279
11/64	.1719		1/4	2-5/8	7/8	9/16	1-7/16	51286	51386	51336
3/16	.1875		1/4	2-5/8	1	21/32	1-7/16	51287	51387	51337
7	.2010	1/4-20	1/4	2-5/8	1	21/32	1-7/16	51288	51388	51338
13/64	.2031		1/4	2-5/8	1	21/32	1-7/16	51289	51389	51339
3	.2130	1/4-28	1/4	2-5/8	1	21/32	1-7/16	51290	51390	51340
7/32	.2188	1/4-32	1/4	2-5/8	1	21/32	1-7/16	51291	51391	51341
15/64	.2344		1/4	2-5/8	1	21/32	1-7/16	51292	51392	51342
1/4	.2500		1/4	3-1/8	1-5/16	7/8	1-7/16	51293	51393	51343
F	.2570	5/16-18	5/16	3-1/8	1-5/16	7/8	1-7/16	51294	51394	51344
17/64	.2656	5/16-20	5/16	3-1/8	1-5/16	7/8	1-7/16	51295	51395	51345
I	.2720	5/16-24	5/16	3-1/8	1-5/16	7/8	1-7/16	51296	51396	51346
9/32	.2812	5/16-32	5/16	3-1/8	1-9/16	1	1-7/16	51297	51397	51347
19/64	.2969		5/16	3-1/8	1-9/16	1	1-7/16	51298	51398	51348
5/16	.3125	3/8-16	5/16	3-1/8	1-9/16	1	1-7/16	51299	51399	51349
21/64	.3281	3/8-20	3/8	3-1/2	1-27/32	1-3/8	1-9/16	51300	51400	51350
Q	.3320	3/8-24	3/8	3-1/2	1-27/32	1-3/8	1-9/16	51301	51401	51351
11/32	.3438	3/8-32	3/8	3-1/2	1-27/32	1-3/8	1-9/16	51302	51402	51352
23/64	.3594		3/8	3-1/2	1-27/32	1-3/8	1-9/16	51303	51403	51353
U	.3680	7/16-14	3/8	3-1/2	1-27/32	1-3/8	1-9/16	51304	51404	51354
3/8	.3750		3/8	3-1/2	1-27/32	1-3/8	1-9/16	51305	51405	51355
25/64	.3906	7/16-20	1/2	3-1/2	1-27/32	1-3/8	1-9/16	51306	51406	51356
13/32	.4062		1/2	4-1/16	2-3/16	1-9/16	1-49/64	51307	51407	51357

continued on page 42

Fractional: shank flat optional (quoted on request)

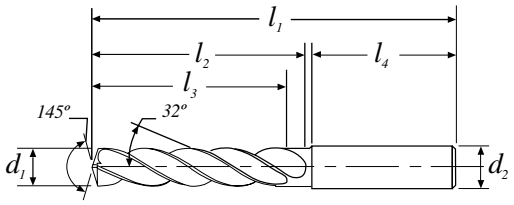
HI-PERCARB®

HIGH PERFORMANCE CARBIDE DRILLS

Wire • Letter - HI-PERCARB® - Series 135

(continued from page 41)

Fractional



Cutting Diameter d_1	Decimal Equivalent	Tap Size Reference Only	Shank Diameter d_2	Overall Length l_1	Flute Length l_2	Min. Cleared Length l_3	Min. Shank Length l_4	Ti-NAMITE (TiN) EDP No.	Ti-NAMITE-C (TiCN) EDP No.	Ti-NAMITE-A (AlTiN) EDP No.
27/64	.4219	1/2-13	1/2	4-1/16	2-3/16	1-9/16	1-49/64	51308	51408	51358
7/16	.4375	1/4-18NPT	1/2	4-1/16	2-3/16	1-9/16	1-49/64	51309	51409	51359
29/64	.4531	1/2-20	1/2	4-1/16	2-3/16	1-9/16	1-49/64	51310	51410	51360
15/32	.4688	1/2-28	1/2	4-1/16	2-3/16	1-9/16	1-49/64	51311	51411	51361
31/64	.4844	9/16-12	1/2	4-1/4	2-5/16	1-5/8	1-49/64	51312	51412	51362
1/2	.5000	9/16-18	1/2	4-1/4	2-5/16	1-5/8	1-49/64	51313	51413	51363
33/64	.5156	9/16-24	5/8	4-1/4	2-5/16	1-5/8	1-49/64	51314	51414	51364
17/32	.5312	5/8-11	5/8	4-1/4	2-5/16	1-5/8	1-49/64	51315	51415	51365
9/16	.5625		5/8	4-9/16	2-1/2	1-3/4	1-57/64	51316	51416	51366
37/64	.5781	5/8-18	5/8	4-9/16	2-1/2	1-3/4	1-57/64	51317	51417	51367
5/8	.6250	11/16-16	5/8	4-9/16	2-1/2	1-3/4	1-57/64	51318	51418	51368
21/32	.6562	3/4-10	3/4	4-7/8	2-3/4	2	1-57/64	51319	51419	51369
11/16	.6875	3/4-16	3/4	4-7/8	2-3/4	2	1-57/64	51320	51420	51370
3/4	.7500	13/16-16	3/4	5-1/4	3-1/16	2-1/8	1-31/32	51321	51421	51371
49/64	.7656	7/8-9	7/8	5-1/4	3-1/16	2-1/8	1-31/32	51322	51422	51372
13/16	.8125	7/8-14	7/8	6	3-11/16	2-17/32	2-1/8	51323	51423	51373
7/8	.8750	1-8	7/8	6	3-11/16	2-17/32	2-1/8	51324	51424	51374
59/64	.9219	1-12	1	6	3-11/16	2-17/32	2-1/8	51325	51425	51375

Fractional: shank flat optional (quoted on request)

Series 135M - HI-PERCARB®

Metric

Cutting Diameter d_1 mm	Decimal Equivalent	Tap Size Reference Only	Shank Diameter d_2	Overall Length l_1	Flute Length l_2	Min. Cleared Length l_3	Min. Shank Length l_4	Ti-NAMITE (TiN) EDP No.	Ti-NAMITE-C (TiCN) EDP No.	Ti-NAMITE-A (AlTiN) EDP No.
3	0.1181		6	62	20	14	36	63095	63215	63155
3,2	0.1260		6	62	20	14	36	63096	63216	63156
3,3	0.1299	M4 (4 x 0,7)	6	62	20	14	36	63097	63217	63157
3,4	0.1339		6	62	20	14	36	63098	63218	63158
3,5	0.1378		6	62	20	14	36	63099	63219	63159
3,6	0.1417		6	62	20	14	36	63100	63220	63160
3,7	0.1457	M4,5 (4,5 x 0,75)	6	62	20	14	36	63101	63221	63161
4	0.1575		6	66	24	17	36	63102	63222	63162
4,2	0.1654	M5 (5 x 0,8)	6	66	24	17	36	63103	63223	63163
4,3	0.1693		6	66	24	17	36	63104	63224	63164
4,5	0.1772		6	66	24	17	36	63105	63225	63165
4,6	0.1811		6	66	24	17	36	63106	63226	63166
4,8	0.1890		6	66	28	20	36	63107	63227	63167
5	0.1969	M6 (6 x 1)	6	66	28	20	36	63108	63228	63168
5,25	0.2067		6	66	28	20	36	63109	63229	63169
5,3	0.2087		6	66	28	20	36	63110	63230	63170
5,5	0.2165		6	66	28	20	36	63111	63231	63171
5,8	0.2283		6	66	28	20	36	63112	63232	63172
6	0.2362	M7 (7 x 1)	6	66	28	20	36	63113	63233	63173
6,25	0.2461		8	79	34	24	36	63114	63234	63174
6,4	0.2520		8	79	34	24	36	63115	63235	63175
6,5	0.2559		8	79	34	24	36	63153	63273	63213
6,8	0.2677	M8 (8 x 1,25)	8	79	34	24	36	63116	63236	63176
7	0.2756	8 x 1	8	79	34	24	36	63117	63237	63177
7,25	0.2854		8	79	41	29	36	63118	63238	63178
7,5	0.2953		8	79	41	29	36	63119	63239	63179
7,8	0.3071	M9 (9 x 1,25)	8	79	41	29	36	63120	63240	63180
8	0.3150		8	79	41	29	36	63121	63241	63181
8,4	0.3307		10	89	47	35	40	63122	63242	63182
8,5	0.3346	M10 (10 x 1,5)	10	89	47	35	40	63123	63243	63183
8,8	0.3465	10 x 1,25	10	89	47	35	40	63124	63244	63184
9	0.3543		10	89	47	35	40	63125	63245	63185
9,25	0.3642		10	89	47	35	40	63126	63246	63186
9,5	0.3740	11 x 1,5	10	89	47	35	40	63127	63247	63187
10	0.3937		10	89	47	35	40	63128	63248	63188
10,2	0.4015	M12 (12 x 1,75)	12	102	55	40	45	63129	63249	63189
10,5	0.4134		12	102	55	40	45	63130	63250	63190
10,8	0.4251	12 x 1,25	12	102	55	40	45	63131	63251	63191
11	0.4331		12	102	55	40	45	63132	63252	63192
11,25	0.4429		12	102	55	40	45	63133	63253	63193
11,5	0.4528		12	102	55	40	45	63134	63254	63194
12	0.4724	M14 (14 x 2)	12	102	55	40	45	63135	63255	63195
12,5	0.4921	14 x 1,5	14	107	60	43	45	63136	63256	63196
12,8	0.5039		14	107	60	43	45	63137	63257	63197
13	0.5118		14	107	60	43	45	63138	63258	63198
13,5	0.5315		14	107	60	43	45	63139	63259	63199
14	0.5512	M16 (16 x 2)	14	107	60	43	45	63140	63260	63200
14,5	0.5709	16 x 1,5	16	115	65	45	48	63141	63261	63201
15	0.5906		16	115	65	45	48	63142	63262	63202
15,5	0.6102	M18 (18 x 2,5)	16	115	65	45	48	63143	63263	63203
16	0.6299		16	115	65	45	48	63144	63264	63204
16,5	0.6496	18 x 1,5	18	123	73	51	48	63145	63265	63205
17	0.6693		18	123	73	51	48	63146	63266	63206
17,5	0.6890	M20 (20 x 2,5)	18	123	73	51	48	63147	63267	63207
18	0.7087		18	123	73	51	48	63148	63268	63208
18,5	0.7283	20 x 1,5	20	131	79	55	50	63149	63269	63209
19	0.7480		20	131	79	55	50	63150	63270	63210
19,5	0.7677	M22 (22 x 2,5)	20	131	79	55	50	63151	63271	63211
20	0.7874		20	131	79	55	50	63152	63272	63212

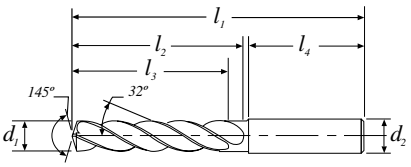
Metric: shank to DIN 6535 HA (6535 HB quoted on request)

HI-PERCARB® L

HIGH PERFORMANCE CARBIDE DRILLS

Wire • Letter - HI-PERCARB®-L - Series 135L

Long Lengths increase drilling depths up to 5 times diameter



Fractional

Cutting Diameter d_1	Decimal Equivalent	Tap Size Reference Only	Shank Diameter d_2	Overall Length l_1	Flute Length l_2	Min. Cleared Length l_3	Min. Shank Length l_4	Ti-NAMITE (TiN) EDP No.	Ti-NAMITE-C (TiCN) EDP No.	Ti-NAMITE-A (AlTiN) EDP No.
7	.2010	1/4-20	1/4	3-1/4	1-3/4	1-3/8	1-7/16	51426	51466	51506
13/64	.2031		1/4	3-1/4	1-3/4	1-3/8	1-7/16	51427	51467	51507
4	.2090	1/4-24	1/4	3-1/4	1-3/4	1-3/8	1-7/16	51428	51468	51508
3	.2130	1/4-28	1/4	3-1/4	1-3/4	1-3/8	1-7/16	51429	51469	51509
7/32	.2188	1/4-32	1/4	3-1/4	1-3/4	1-3/8	1-7/16	51430	51470	51510
1/4	.2500		1/4	3-5/8	2-5/64	1-45/64	1-7/16	51431	51471	51511
F	.2570	5/16-18	5/16	3-5/8	2-5/64	1-45/64	1-7/16	51432	51472	51512
17/64	.2656	5/16-20	5/16	3-5/8	2-5/64	1-45/64	1-7/16	51433	51473	51513
I	.2720	5/16-24	5/16	3-5/8	2-5/64	1-45/64	1-7/16	51434	51474	51514
9/32	.2812	5/16-32	5/16	3-5/8	2-5/64	1-45/64	1-7/16	51435	51475	51515
19/64	.2969		5/16	3-5/8	2-5/64	1-45/64	1-7/16	51436	51476	51516
5/16	.3125	3/8-16	5/16	3-5/8	2-5/64	1-45/64	1-7/16	51437	51477	51517
P	.3230		3/8	4	2-13/32	2	1-9/16	51438	51478	51518
21/64	.3281	3/8-20	3/8	4	2-13/32	2	1-9/16	51439	51479	51519
Q	.3320	3/8-24	3/8	4	2-13/32	2	1-9/16	51440	51480	51520
11/32	.3438	3/8-32	3/8	4	2-13/32	2	1-9/16	51441	51481	51521
S	.3480	1/8-27NPS	3/8	4	2-13/32	2	1-9/16	51442	51482	51522
23/64	.3594		3/8	4	2-13/32	2	1-9/16	51443	51483	51523
U	.3680	7/16-14	3/8	4	2-13/32	2	1-9/16	51444	51484	51524
3/8	.3750		3/8	4	2-13/32	2	1-9/16	51445	51485	51525
W	.3860		1/2	4	2-13/32	2	1-9/16	51446	51486	51526
25/64	.3906	7/16-20	1/2	4	2-13/32	2	1-9/16	51447	51487	51527
13/32	.4062		1/2	4-11/16	2-3/4	2-13/64	1-49/64	51448	51488	51528
27/64	.4219	1/2-13	1/2	4-11/16	2-3/4	2-13/64	1-49/64	51449	51489	51529
7/16	.4375	1/4-18NPT	1/2	4-11/16	2-3/4	2-13/64	1-49/64	51450	51490	51530
29/64	.4531	1/2-20	1/2	4-11/16	2-3/4	2-13/64	1-49/64	51451	51491	51531
15/32	.4688	1/2-28	1/2	4-11/16	2-3/4	2-13/64	1-49/64	51452	51492	51532
31/64	.4844	9/16-12	1/2	4-7/8	3-1/32	2-3/8	1-49/64	51453	51493	51533
1/2	.5000	9/16-18	1/2	4-7/8	3-1/32	2-3/8	1-49/64	51454	51494	51534
33/64	.5156	9/16-24	5/8	4-7/8	3-1/32	2-3/8	1-49/64	51455	51495	51535
17/32	.5312	5/8-11	5/8	4-7/8	3-1/32	2-3/8	1-49/64	51456	51496	51536
35/64	.5469	5/8-12	5/8	4-7/8	3-1/32	2-3/8	1-49/64	51457	51497	51537
9/16	.5625		5/8	5-1/4	3-1/4	2-1/2	1-57/64	51458	51498	51538
37/64	.5781	5/8-18	5/8	5-1/4	3-1/4	2-1/2	1-57/64	51459	51499	51539
5/8	.6250	11/16-16	5/8	5-1/4	3-1/4	2-1/2	1-57/64	51460	51500	51540
21/32	.6562	3/4-10	3/4	5-5/8	3-5/8	2-3/4	1-57/64	51461	51501	51541
11/16	.6875	3/4-16	3/4	5-5/8	3-5/8	2-3/4	1-57/64	51462	51502	51542
45/64	.7031	3/4-20	3/4	5-5/8	3-5/8	2-3/4	1-57/64	51463	51503	51543
47/64	.7344	13/16-12	3/4	6	4	3	1-31/32	51464	51504	51544
3/4	.7500	13/16-16	3/4	6	4	3	1-31/32	51465	51505	51545

Fractional: shank flat optional (quoted on request)

HI-PERCARB® HIGH PERFORMANCE CARBIDE DRILLS

HI-PERCARB® L HIGH PERFORMANCE CARBIDE DRILLS

Speed and Feed Recommendations

Material Classification	Hardness (Bhn)		Speed (sfm)		Drill Diameter / Feed per Revolution					
					.031 - .111 in. (1 - 2.5 mm)	.118 - .197 in. (3 – 5 mm)	.203 - .316 in. (5.5 – 8 mm)	.328 - .500 in. (8.5 – 12.5 mm)	.512 - .640 in. (13 – 16 mm)	.650 - .875 in. (16.5 – 20mm)
	Bhn	Rc	sfm	m/min						
low carbon steel 1018	≤ 170	≤ 5	400	120	.0010 - .005 (.025 - .13)	.005 - .008 (.13 - .21)	.008 - .012 (.21 - .31)	.012 - .016 (.31 - .40)	.016 - .020 (.40 - .50)	.020 - .024 (.50 - .60)
alloyed steel 4140	≤ 270	≤ 28	300	90	.0007 - .004 (.018 - .10)	.004 - .006 (.10 - .15)	.006 - .009 (.15 - .23)	.009 - .012 (.23 - .31)	.012 - .015 (.31 - .38)	.015 - .018 (.38 - .45)
cast iron	150-200	1-15	400	120	.0015 - .010 (.038 - .25)	.010 - .014 (.25 - .36)	.014 - .017 (.36 - .43)	.017 - .020 (.43 - .51)	.020 - .024 (.51 - .61)	.024 - .028 (.61 - .71)
	200-300	15-30	245	75	.0010 - .008 (.025 - .21)	.008 - .012 (.21 - .31)	.012 - .014 (.31 - .36)	.014 - .017 (.36 - .43)	.017 - .020 (.43 - .51)	.020 - .024 (.51 - .61)
	300-400	30-45	190	60	.0008 - .006 (.020 - .15)	.006 - .010 (.15 - .25)	.010 - .012 (.25 - .31)	.012 - .015 (.31 - .38)	.015 - .018 (.38 - .46)	.018 - .020 (.46 - .51)
tool steel H-13	≤ 170	≤ 5	230	70	.0006 - .003 (.015 - .75)	.003 - .005 (.75 - .13)	.005 - .007 (.13 - .18)	.007 - .010 (.18 - .25)	.010 - .013 (.25 - .33)	.013 - .016 (.33 - .40)
stainless steel 300 Series	≤ 170	≤ 5	70-140	20-45	.0005 - .002 (.012 - .05)	.002 - .004 (.05 - .10)	.004 - .006 (.10 - .15)	.006 - .008 (.15 - .21)	.008 - .010 (.21 - .25)	.010 - .012 (.25 - .31)
titanium 6Al4V	≤ 280	≤ 29	100	30	.0003 - .002 (.007 - .050)	.002 - .003 (.050 - .075)	.003 - .004 (.075 - .100)	.004 - .006 (.10 - .15)	.006 - .008 (.15 - .21)	.008 - .010 (.21 - .25)
high temp alloys Inconel 718	≤ 220	≤ 18	50	15	.0002 - .001 (.005 - .025)	.001 - .002 (.025 - .050)	.002 - .003 (.050 - .075)	.003 - .004 (.075 - .100)	.004 - .005 (.10 - .13)	.005 - .006 (.13 - .15)

Reduce speed 20% when hole depth exceeds 3 diameters

Tolerances (inch)		
Diameter	d_1	d_2
≤ 34	+.0001/+.0005	+.0000/–.0003
> 34 – 1/4	+.0002/+.0006	+.0000/–.0003
> 1/4 – 3/8	+.0002/+.0008	+.0000/–.0004
> 3/8 – 3/4	+.0003/+.0010	+.0000/–.0004
> 3/4 – 1	+.0003/+.0011	+.0000/–.0004

Tolerances (mm)		
Diameter	d_1	d_2
≤ 3	+0,0025/+0,0127	+0,0000/–0,0050
> 3 – 6	+0,0050/+0,0152	+0,0000/–0,0076
> 6 – 10	+0,0050/+0,0200	+0,0000/–0,0102
> 10 – 18	+0,0076/+0,0254	+0,0000/–0,0102
> 18 – 30	+0,0076/+0,0279	+0,0000/–0,0102

Amorphous Diamond – AD

Extends Tool Life up to 6 Times Longer than AlTiN Coated Tools

Diamond thin-film offers a low coefficient of friction, excellent abrasion resistance, good thermal and chemical stability, and high hardness at drastically reduced costs.

Graphite milling tests have shown that SGS Amorphous Diamond film can last up to 6 times longer than AlTiN coated carbide tools, but actual tool life will depend on operating conditions.

Characteristics of Diamond Coatings

Property	Amorphous	CVD Diamond
Diamond Structure	Amorphous	Crystalline
Hardness(Gpa) Surface	60 - 95	85 - 100
Roughness Thickness	Smooth ≤ 1 micron	Rough 6 - 20 microns
Deposition Temperature C	150° C	850° - 900°
Special Grade Substrate	No *	Yes

* Any SGS solid carbide tool in stock can be coated with Amorphous Diamond

Amorphous Diamond

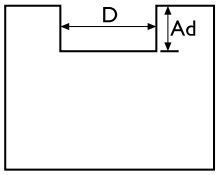
SGS Tool Company is pleased to offer Amorphous Diamond coated, solid carbide end mills to machine nonferrous materials such as graphite, where a cutter's resistance to abrasiveness is paramount. Graphite electrodes can be accurately milled with Amorphous Diamond coated end mills to produce electrodes with exacting detail at an affordable cost. In addition, finishing in graphite, high silicon aluminum, Fiberglass reinforced plastics, and green (pre-sintered) ceramics are other applications well-suited for SGS Amorphous Diamond coated end mills.

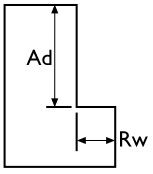
Diamond Thin Film Characteristics

SGS Amorphous Diamond tools are coated with thin film diamond. The thin film diamond conforms to the precise contour of the tool producing a shiny, slippery coating. An outstanding feature of Diamond thin-film is its high resistance to abrasive wear. With its low friction coefficient, the tool runs much cooler and prevents workpiece material from adhering to the cutting edges. This becomes a distinct advantage when no coolant is used in machining graphite.

Speed and Feed Recommendations

Cutting Diameter Inch	mm	Feed Rate per Tooth					
		Slotting		Peripheral		Contouring	
Finishing		Rw 1 x D	Ad .03 x D	Rw .06 x D	Ad .45 x D	Rw .02 x D	Ad .03 x D
		Speed 3280 - 5900 sfm (1000 - 1800 m/min)					
Roughing		Rw 1 x D	Ad .25 x D	Rw .1 x D	Ad .65 x D	Rw .1 x D	Ad .25 x D
		Speed 1310 – 1970 sfm (400 – 600 m/min)					
1/16	1,6	0.0003 in	(0.008mm)	0.0004 in	(0.010 mm)	0.0005 in	(0.011mm)
1/8	3	0.0006 in	(0.016mm)	0.0008 in	(0.020 mm)	0.0009 in	(0.022mm)
3/16	5	0.0013 in	(0.032mm)	0.0016 in	(0.041 mm)	0.0017 in	(0.044mm)
1/4	6	0.0013 in	(0.032mm)	0.0016 in	(0.041 mm)	0.0017 in	(0.044mm)
5/16	8	0.0027 in	(0.068mm)	0.0034 in	(0.086 mm)	0.0037 in	(0.094mm)
3/8	10	0.0027 in	(0.068mm)	0.0034 in	(0.086 mm)	0.0037 in	(0.094mm)
1/2	12	0.0041 in	(0.103mm)	0.0046 in	(0.117 mm)	0.0050 in	(0.127mm)

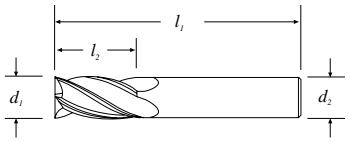




Fractional

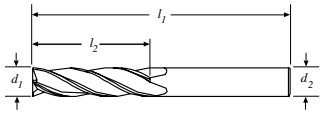
4 Flute - Square End

Series 1



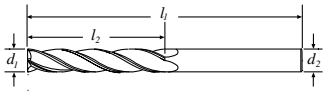
Cutting Diameter d_1	Length of Cut l_2	Overall Length l_1	Shank Diameter d_2	EDP No.
1/64	1/32	1-1/2	1/8	93300
1/32	5/64	1-1/2	1/8	93301
3/64	7/64	1-1/2	1/8	93302
1/16	3/16	1-1/2	1/8	93303
5/64	3/16	1-1/2	1/8	93304
3/32	9/32	1-1/2	1/8	93305
7/64	3/8	1-1/2	1/8	93306
1/8	1/2	1-1/2	1/8	93307
3/16	5/8	2	3/16	93308
1/4	3/4	2-1/2	1/4	93309
5/16	13/16	2-1/2	5/16	93310
3/8	1	2-1/2	3/8	93311
7/16	1	2-3/4	7/16	93344
1/2	1	3	1/2	93345

Series 1L Long



Cutting Diameter d_1	Length of Cut l_2	Overall Length l_1	Shank Diameter d_2	EDP No.
1/8	3/4	2-1/4	1/8	93324
3/16	3/4	2-1/2	3/16	93325
1/4	1-1/8	3	1/4	93326
5/16	1-1/8	3	5/16	93327
3/8	1-1/8	3	3/8	93328

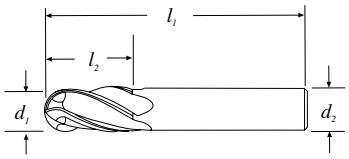
Series 1EL Extra Long



Cutting Diameter d_1	Length of Cut l_2	Overall Length l_1	Shank Diameter d_2	EDP No.
1/8	1	3	1/8	93334
3/16	1-1/8	3	3/16	93335
1/4	1-1/2	4	1/4	93336
5/16	1-5/8	4	5/16	93337
3/8	1-3/4	4	3/8	93338

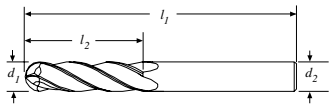
4 Flute - Ball End

Series 1B



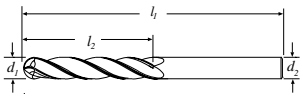
Cutting Diameter d_1	Length of Cut l_2	Overall Length l_1	Shank Diameter d_2	EDP No.
1/64	1/32	1-1/2	1/8	93312
1/32	5/64	1-1/2	1/8	93313
3/64	7/64	1-1/2	1/8	93314
1/16	3/16	1-1/2	1/8	93315
5/64	3/16	1-1/2	1/8	93316
3/32	9/32	1-1/2	1/8	93317
7/64	3/8	1-1/2	1/8	93318
1/8	1/2	1-1/2	1/8	93319
3/16	5/8	2	3/16	93320
1/4	3/4	2-1/2	1/4	93321
5/16	13/16	2-1/2	5/16	93322
3/8	1	2-1/2	3/8	93323
7/16	1	2-3/4	7/16	93346
1/2	1	3	1/2	93347

Series 1LB Long



Cutting Diameter d_1	Length of Cut l_2	Overall Length l_1	Shank Diameter d_2	EDP No.
1/8	3/4	2-1/4	1/8	93329
3/16	3/4	2-1/2	3/16	93330
1/4	1-1/8	3	1/4	93331
5/16	1-1/8	3	5/16	93332
3/8	1-1/8	3	3/8	93333

Series 1ELB Extra Long



Cutting Diameter d_1	Length of Cut l_2	Overall Length l_1	Shank Diameter d_2	EDP No.
1/8	1	3	1/8	93339
3/16	1-1/8	3	3/16	93340
1/4	1-1/2	4	1/4	93341
5/16	1-5/8	4	5/16	93342
3/8	1-3/4	4	3/8	93343

DIA-CARB™

Diamond Coating

CVD - Diamond Coated Solid Carbide End Mills

SGS Tool Company is pleased to announce the development of CVD Diamond Coated solid carbide end mills to machine abrasive materials such as graphite compositions used to produce electrodes for Electrical Discharge Machining (EDM) and machining carbon – carbon composites. Graphite electrodes can be accurately milled with diamond coated end mills to produce electrodes with exacting detail because the crystalline diamond CVD coating effectively resists tool wear.

Note: Machining graphite produces abrasive dust. Use ventilation as necessary.

Characteristics

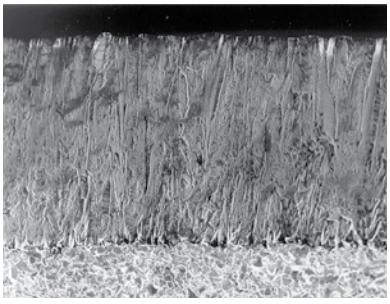
The characteristics of CVD Diamond Coatings are shown below. The SGS Diamond coating process produces a controlled, uniform coating and performance on all tools.

Thickness	6 - 10	µm
Grain Size	1/2 - 3	µm
Hardness (Knoop)	85 - 100	GPa

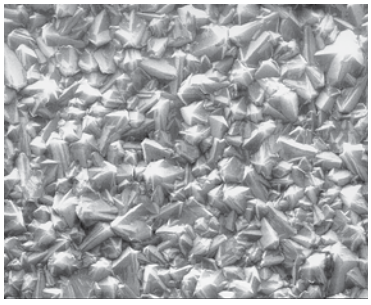
Diamond Coating Characteristics

SGS Diamond Coated tools are coated with hard crystalline (cF8) diamond producing an adherent, continuous diamond coating on solid carbide tools that wears like natural diamonds.

A section of the coating and the coating surface are shown below:



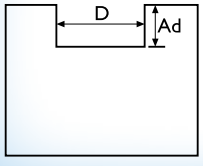
Cross-section of diamond coating on a carbide substrate.
10 µm

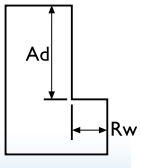


Diamond coated surface showing individual diamond crystals.
10 µm

Diamond coating extends the accurate cutting life of carbide tools. Graphite milling tests have shown that **SGS Diamond Coated Tools** can last from **10 to 80 times longer** than uncoated carbide tools, but actual tool life will depend on operating conditions.

Speed and Feed Recommendations

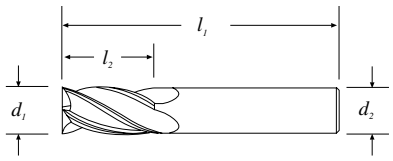




Cutting Diameter Inch	mm	Feed Rate per Tooth					
		Slotting		Peripheral		Contouring	
Finishing		Rw 1 x D	Ad .03 x D	Rw .06 x D	Ad .45 x D	Rw .02 x D	Ad .03 x D
		Speed 3280 - 5900 sfm (1000 - 1800 m/min)					
Roughing		Rw 1 x D	Ad .25 x D	Rw .1 x D	Ad .65 x D	Rw .1 x D	Ad .25 x D
		Speed 1310 – 1970 sfm (400 – 600 m/min)					
1/16	1,6	0.0003 in	(0.008mm)	0.0004 in	(0.010 mm)	0.0005 in	(0.011mm)
1/8	3	0.0006 in	(0.016mm)	0.0008 in	(0.020 mm)	0.0009 in	(0.022mm)
3/16	5	0.0013 in	(0.032mm)	0.0016 in	(0.041 mm)	0.0017 in	(0.044mm)
1/4	6	0.0013 in	(0.032mm)	0.0016 in	(0.041 mm)	0.0017 in	(0.044mm)
5/16	8	0.0027 in	(0.068mm)	0.0034 in	(0.086 mm)	0.0037 in	(0.094mm)
3/8	10	0.0027 in	(0.068mm)	0.0034 in	(0.086 mm)	0.0037 in	(0.094mm)
1/2	12	0.0041 in	(0.103mm)	0.0046 in	(0.117 mm)	0.0050 in	(0.127mm)

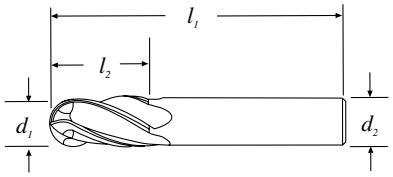
Series 1 - 4 Flute - Square End

Cutting Diameter d_1	Length of Cut l_2	Overall Length l_1	Shank Diameter d_2	Dia-Carb EDP No.
1/16	3/16	1-1/2	1/8	91268
1/8	1/2	1-1/2	1/8	91272
3/16	5/8	2	3/16	91276
1/4	3/4	2-1/2	1/4	91280
5/16	13/16	2-1/2	5/16	91284
3/8	1	2-1/2	3/8	91288
1/2	1	3	1/2	91292



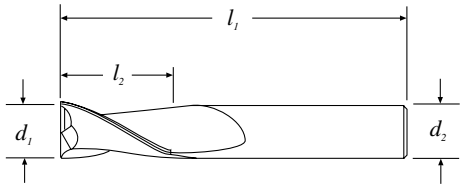
Series 1B - 4 Flute - Ball End

Cutting Diameter d_1	Length of Cut l_2	Overall Length l_1	Shank Diameter d_2	Dia-Carb EDP No.
1/16	3/16	1-1/2	1/8	91269
1/8	1/2	1-1/2	1/8	91273
3/16	5/8	2	3/16	91277
1/4	3/4	2-1/2	1/4	91281
5/16	13/16	2-1/2	5/16	91285
3/8	1	2-1/2	3/8	91289
1/2	1	3	1/2	91293



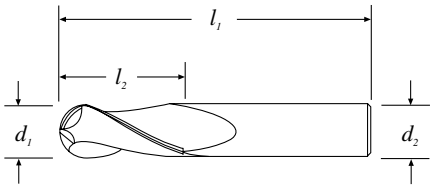
Series 3 - 2 Flute - Square End

Cutting Diameter d_1	Length of Cut l_2	Overall Length l_1	Shank Diameter d_2	Dia-Carb EDP No.
1/16	3/16	1-1/2	1/8	91266
1/8	1/2	1-1/2	1/8	91270
3/16	5/8	2	3/16	91274
1/4	3/4	2-1/2	1/4	91278
5/16	13/16	2-1/2	5/16	91282
3/8	1	2-1/2	3/8	91286
1/2	1	3	1/2	91290



Series 3B - 2 Flute - Ball End

Cutting Diameter d_1	Length of Cut l_2	Overall Length l_1	Shank Diameter d_2	Dia-Carb EDP No.
1/16	3/16	1-1/2	1/8	91267
1/8	1/2	1-1/2	1/8	91271
3/16	5/8	2	3/16	91275
1/4	3/4	2-1/2	1/4	91279
5/16	13/16	2-1/2	5/16	91283
3/8	1	2-1/2	3/8	91287
1/2	1	3	1/2	91291



Ti-NAMITE® TOOL COATINGS

Ti-NAMITE® Tool Coatings are specifically engineered for SGS® solid carbide rotary tools. This proprietary multi-layering process results in maximized tool life and increased speed and feed rates in any application.

Ti-NAMITE-A®

Recommended For Your Applications In...

- Cast Iron
- High-temperature Alloys
- Hardened Steels
- Stainless Steels

Ti-NAMITE-A (AlTiN) is Preferred for High-speed and Dry Cutting

Hardness: 3300HV$_{0.05}$

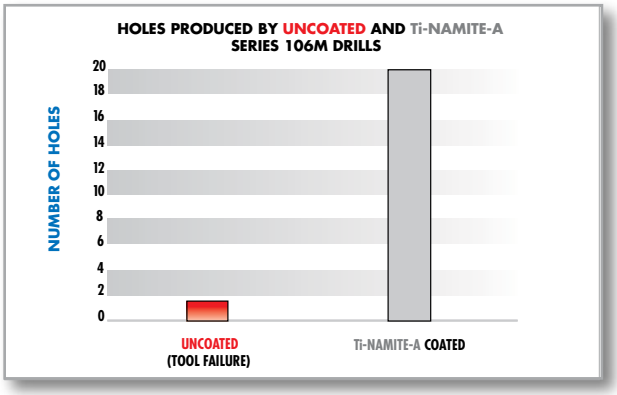
Oxidation Temperature: 800°C - 1472°F

Coefficient Of Friction: .45

Thickness: 1 - 4 Microns (based on tool diameter)

Drilling Hardened Tool Steel

Tool Type	Series 106M 6mm .2362	Series 106M 6mm .2362
Condition	UNCOATED	Ti-NAMITE-A
Material Type	ISO 4957S5H5653 M4 @ 64 HRc	ISO 4957S5H5653 M4 @ 64 HRc
Depth of Cut	15 mm .519"	15 mm .519"
Width of Cut	6 mm .2362"	6 mm .2362"
Spindle Speed	9 m/min. 477 rpm	9m/min. 477 rpm
Feed	25.4 mm/min. 1 IPM	25.4 mm/min. 1 IPM



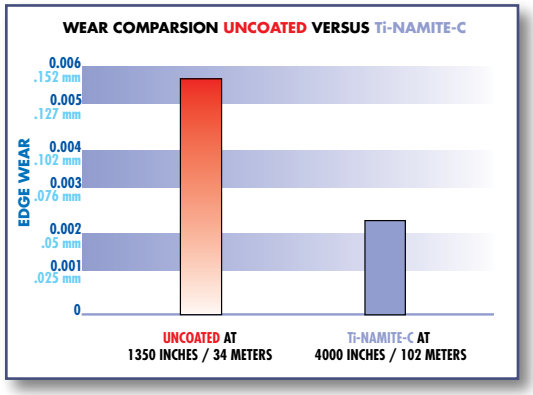
Ti-NAMITE-C®

Recommended For Your Applications In...

- High Silicon
- Aluminum Alloys
- Titanium Alloys
- Low Carbon Steel
- Alloyed Steels

Milling Application Data

Tool Type	Series 1 1/2" 12.7 mm	Series 1 1/2" 12.7mm
Condition	UNCOATED	Ti-NAMITE-C
Material Type	1018 STEEL DIN 1.0453	1018 STEEL DIN 1.0453
Depth of Cut	.500" 12.7 mm	.500" 12.7 mm
Width of Cut	.125" 3.2 mm	.125" 3.2 mm
Spindle Speed	2782 rpm 111 m/min.	4185 rpm 167 m/min.
Feed	33 IPM 838 mm/min.	50 IPM 1270 mm/min.



Hardness: 3000HV0.05

Oxidation Temperature: 400°C - 752°F

Coefficient Of Friction: .3 - .45

Thickness: 1 - 4 Microns (based on tool diameter)

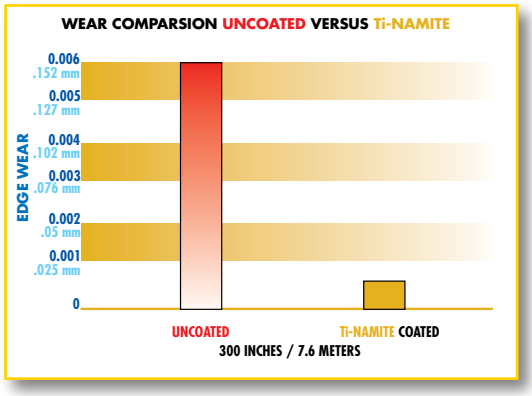
Ti-NAMITE®

Recommended For General Purpose And Applications In...

- Stainless Steel
- Medium Carbon Steel
- Alloyed Steel
- Copper Alloys
- Brass
- Bronze

Milling Application Data

Tool Type	Series 1 1/2" 12.7 mm	Series 1 1/2" 12.7mm
Condition	UNCOATED	Ti-NAMITE
Material Type	4140 STEEL DIN 1.7225	4140 STEEL DIN 1.7225
Depth of Cut	.500" 12.7 mm	.500" 12.7 mm
Width of Cut	.125" 3.18 mm	.125" 3.18 mm
Spindle Speed	1955 rpm 78 m/min.	2933 rpm 117 m/min.
Feed	23.5 IPM 596.9 mm/m	32.5 IPM 825.5 mm/m



Hardness: 2200HV0.05

Oxidation Temperature: 600°C - 1112°F

Coefficient Of Friction: .4 - .65

Thickness: 1 - 4 Microns (based on tool diameter)

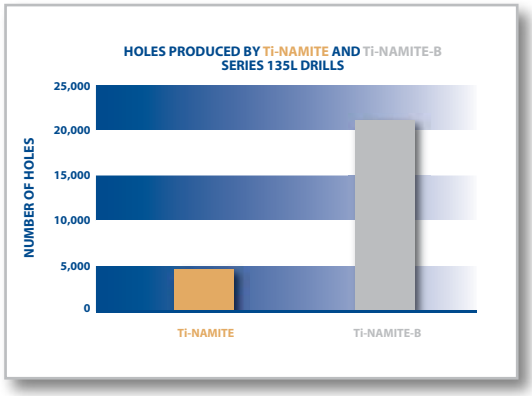
Ti-NAMITE-B®

Recommended For Your Applications In...

- High Silicon Aluminum Alloys
- Titanium Alloys

Milling Application Data

Tool Type	Series 135L 1/4" 6.35 mm	Series 135L 1/4" 6.35 mm
Condition	Ti-NAMITE	Ti-NAMITE-B
Material Type	6061 Aluminum DIN AlMg1SiCu	6061 Aluminum DIN AlMg1SiCu
Depth of Cut	1.600" 40.6 mm	1.600" 40.6 mm
Width of Cut	.2500" 6.35 mm	.2500" 6.35 mm
Spindle Speed	7500 rpm 150 m/min.	7500 rpm 200 m/min.
Feed	60 IPM 1524 mm/m	80 IPM 2032 mm/m



Hardness: 4000HV

Oxidation Temperature: 850°C - 1562°F

Coefficient Of Friction: .45

Thickness: 1 - 2 Microns (based on tool diameter)

SGS®
Solid Carbide Tools
An ISO 9001 Certified Company

Sold in Over 60 Countries



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